VOL. XXXI. — No. 2. FEBRUARY 1954.

Monthly Bulletin of the International Railway Congress Association

(English Edition)

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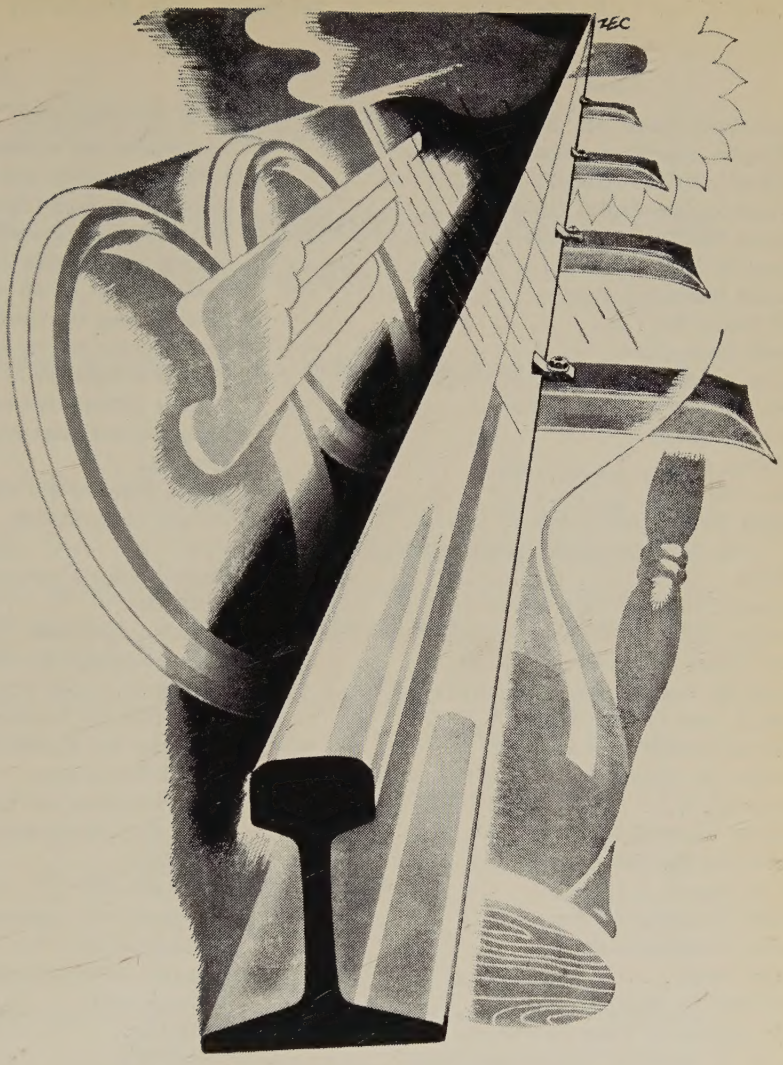

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An edition in French is also published.

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BULLETIN
OF THE
INTERNATIONAL RAILWAY CONGRESS
ASSOCIATION
(ENGLISH EDITION)

[621 .33]

INTERNATIONAL RAILWAY CONGRESS ASSOCIATION

16th SESSION (LONDON, 1954).

QUESTION 11.

Protection of overhead lines, substations, locomotives and motor coaches against accidents of electric nature (excess voltage, overloads, short circuits and lightning...).

REPORT

(Austria, Belgium and Colony, Bulgaria, Czechoslovakia, France and French Union, Germany, Greece, Hungary, Italy, Luxemburg, Netherlands, Poland, Portugal and Colonies, Rumania, Spain, Switzerland, Syria, Turkey and Yugoslavia),

by J. F. M. De Boeck, (*)

Ingénieur en Chef au Service Technique de la Traction et du Matériel de la Société Nationale des Chemins de Fer Vicinaux, Bruxelles.

GENERAL.

Foreword.

The questionnaire relative to the enquiry requested by the International Railway Congress Association has been compiled in agreement with Mr. T.S. Pick, Chief Electrical Engineer of the London Transport Executive, who is the reporter for the same question for English-speaking countries.

It was sent to 70 bodies : Administrations, Societies and Railway Companies.

Fourteen of these have replied, and they are listed in the table on page 193/39.

The following Administrations have stated that they cannot give any useful information, either because they do not operate any electrified lines, or because they consider that the extent of their electrified system is too small :

Compagnie Belge de Chemins de fer et d'Entreprises.
Compagnie d'Exploitation des Transports Coloniaux (OTRACO).
Société Générale des Chemins de fer Economiques.
Gafsa Railway.
Tunisian Railways.

(*) Mr. Vrielynck, Deputy General Manager of the S.N.C.V. who was, at first, designated as reporter for this question with Mr. De Boeck, will assume the chairmanship of the Vth. Section at the London Congress.

French Overseas Railways Office (French West Africa, Togo, etc.).
Franco-Ethiopian Railway (Djibouti-Addis-Ababa).
Mediterranean-Niger Railway.
Cambodian Royal Railways.
Greek State Railways.
Luxemburg Railways.
Portuguese Railways.
Viege-Zermatt Railway.
Freiburg Railway.
Syrian State Railway.
Damas-Hamah Railway.
Turkish State Railways.

The « Agienda Tranviaria Municipale of Milan » considered itself unable to reply as it did not operate any « railway » lines.

* * *

Introduction.

§ 1. — *OBJECT OF THE REPORT.*

The report covers the protection against accidents of an electrical nature of sub-stations, overhead lines and electrically-operated motor vehicles.

In principle, it will not deal with protective gear for generating plants nor with feeder installations for supply of energy for traction purposes between generating plants and using points. This excludes also the distribution gear at the latter points.

This equipment will therefore in all cases be mentioned as primary equipment.

At the request of the Reporter for English-speaking countries, however, several questions have been included on the subject of protective equipment for primary installations : those which belong to Administrations themselves producing the energy or which distribute it from power stations and have a consumption of at least 10 million kWh per annum.

Mr. PICK also asked for the enquiry to be extended to include regenerative braking. These two latter subjects have been dealt with in special chapters.

Finally, the report does not deal with rotary converter groups, as static converters are tending to replace them. The German Federal Railways, the Belgian National Railways, the North of Milan Railway and the Italian State Railways have not reported any rotary converters.

The programme set entailed an extensive questionnaire and this fact must serve to explain the brevity of some of the replies.

* * *

§ 2. — *ARRANGEMENT OF THE REPORT.*

It is divided into six chapters :

Chap. 1. — Protection of primary installations.

Chap. 2. — Protection of static transformers.

Chap. 3. — Protection of static converters.

Chap. 4. — Protection of overhead contact lines and feeders.

Chap. 5. — Protection of electrically operated motor vehicles.

Chap. 6. — Regenerative braking.

The final index gives the sub-divisions of each chapter and the headings are classified decimally.

The appendices are designated by the corresponding heading number and where necessary by a sequence number in addition.

* * *

§ 3. — *GENERAL TABLES.*

1. The appended general tables (index 0/1 - 0/2 - 0/3) provide a survey of the whole of the replies.

In the column « Protection » X shows the presence and O the absence of protective gear.

2. Under the heading « excess voltages », accidents due to causes in the installation itself have been grouped with those due to atmospheric electricity.

The replies received showed that there would be no advantage in making a distinction between them.

* * *

§ 4. — *NOTE.*

The Belgian National Light Railways

only, of all the Administrations replying, mention the use of glass bulb rectifiers. Furthermore, the features of the system (mainly rural or suburban lines in semi-isolated groups) have led to the completely automatic operation of most of the sub-stations.

At the time when the light railways were developed, glass bulbs facilitated this automatic operation.

These two characteristics (glass bulbs and integral automatic operation) involve certain special protective measures.

* * *

§ 5. — *ABBREVIATIONS.*

Associations

A.I.C.C.F. : International Railway Congress Association.

Systems using alternating current :

Deutsche B. : German Federal Railways.

B.-Congo-K. : Lower Congo-Katanga Railway.

C.F. Alpes B. : Bernese Alps (B.L.S.) Railway.

Rhätische B. : Rhaetian Railway.

Systems using direct current :

Deutsche B. : German Federal Railways.

S.N.C. Belges or S.N.C.B. : Belgian National Railways.

S.N.C. Vicinaux : Belgian National Light Railways.

C.F. Algériens : Algerian Railways (Bone-Kouif).

C.F.H. Savoie : French Light Railways of the North (Haute Savoie).

R.A.T. Paris : Régie Autonome des Transports Parisiens.

S.N.C. Français or S.N.C.F. : French National Railways.

C.F. Maroc : Moroccan Railways.

F.N. Milano : North of Milan Railways.

F.d. Stato : Italian State Railways.

N.V. Nederl. S. : Netherlands Railways.

Technical abbreviations :

All accepted international abbreviations and also the following :

In : nominal intensity.

UR : ultra-rapid-acting equipment.

S/Station : sub-station.

* * *

CHAPTER 1.

PROTECTION OF PRIMARY INSTALLATIONS.

Six Administrations replied to this question. It would be dangerous to base conclusions on the replies which have been given. These replies are summarized in Appendix 1.

It is regretted that technical reasons prevent the reproduction of the maps of the systems.

* * *

CHAPTER 2.

PROTECTION OF STATIC TRANSFORMERS.

2. Tables 0/2 and 0/3 contain the protective arrangements used on traction transformers : table 0/2 shows transformers for AC traction and table 0/3 those of AC/DC converter groups.

The principles of protection are the same in the two cases; for this reason, therefore, they have been classified together.

* * *

21. — Overloads and short-circuits.

211. — *MAXIMUM INTENSITY RELAYS.*

The use of these relays is general, either direct or linked to tension limiters. They act on circuit breakers. The replies give insufficient details of the latter to allow any comments. At the same time, it can be stated that the *Deutsche B.* in recent installations has maximum intensity relays

linked to the primary and to the secondary of transformers acting on an ultra high speed circuit breaker of the secondary circuit.

Maximum intensity relays comprise in most cases two devices : one with delayed action ensures protection against overloads; the other, with instantaneous action, operates in the event of a short circuit. The *N.V. Nederl. S.* only mention, however, the instantaneous action.

The *delayed action component* has either a set delay, or a delay which varies inversely to the intensity. It would appear that the first method of timing is the more general.

The limits of intensity regulation vary between a minimum of 1.2 or 1.4 times the nominal intensity (In) to twice the nominal intensity.

The S.N.C.F. alone notes the use of some thermal relays, but this Administration has not adopted them generally. This is because of difficulties in regulation « which make difficult the adaptation of the functioning curve to that of the increase in temperature at the warmest part of the transformer winding in the case of heavy overloading of short duration ». Section 222 includes a mention of equipment designed to solve this problem.

The *S.N.C. Vicinaux* has in use a direct thermal relay equipment. It does not so far seem to offer any practical advantage.

With regard to the *instantaneous-acting component,* the operating intensity should obviously be greater than the peak intensity for engaging the transformer. The *R.A.T. Paris* quotes 5 times In. The *S.N.C.B.* go on to 8 times. Apparatus of the type used by the *S.N.C. Vicinaux* uses a control of between 3 and 4 to 5 times In.

Note.

In the automatic sub-stations of the *S.N.C. Vicinaux* the tripping of the maximum relays for the H.T. circuit-breakers of the converter groups does not necessarily entail putting the group out of service (the group is not necessarily « blocked »). The H.T. circuit breaker can re-close 3 to 5 times during a total delay time, determined by adjustment, of from 9 to 300 seconds. In the latest installations, an interval of 66 seconds has been adopted.

On the contrary, the main H.T. circuit breaker does not reclose automatically. Its relays are adjusted to the maximum compatible with the provisions of the supplier of energy.

212. — *OTHER METHODS OF PROTECTION.*

We may mention as a reminder :

1) The automatic addition of converter groups in proportion to the load. This type of protection is mentioned under heading 3122.

2) The short circuit winding (Kurzschlussdrossel ») which exists in some old installations of the *Deutsche B.*

* * *

22. — **Excessive heating.**

Most organisations, which replied, use thermometers with tripping contacts. It is probably necessary to assume that the « thermostat mounted in the transformer cover » mentioned by the *N.V. Nederl. S.* comes within this class of apparatus.

The *B.-Congo K.* and the *C.F. Maroc* use a thermal reflector. From the description given, this is probably an apparatus on the same principle as the *Deutsche B*'s « Tauberschutz » which they have used in some substations.

221. — *THERMOMETERS WITH TRIP CONTACTS.*

This apparatus has one or two contacts. In the second case, the contact which operates first works an alarm signal and the second cuts out the transformer. Where there is only one contact, it fulfils one or other of these two purposes, varying with the Administration.

A second contact allows a rise with less risk up to the permissible limit of temperature for the oil. The *S.N.C.F.* adjust this contact to 90° C.

Given that in a transformer, it is the temperature of the windings which fixes the limit of heating, and not the temperature of the oil, the procedure described under the following heading appears the most logical.

222. — *THERMAL REFLECTOR.*

The variation of oil temperature is governed by an overall time-constant of the transformer, whilst the rule for temperature variation of the winding depends on the time-constant of the coils. This is much smaller than the former. In other words, the heating of the oil lags behind that of the windings and has not the same amplitude.

In one type of apparatus, an attempt has been made to establish a device comprising an element which reproduces at all times, the heating (temperature variation) at the warmest point of the winding controlled, in relation to the oil in which it is immersed.

This element, known as the thermal feeler, is located at the warmest part of the oil. It consists of a resistance with a constantly measured value, and from this, temperature. It is heated firstly by a winding fed by a current proportional to the current supplying the controlled winding, and secondly by the oil in which it is immersed.

Various casings, of patented design, surround the feeler-coil assembly. They serve to transmit heat between the feeler and the oil in an identical manner to the transmission which takes place between the controlled winding and the oil.

Appendix 222 shows the similarity obtained.

* * *

In a second type of apparatus, the heating resistance is fed by a current proportional to the current to be controlled and surrounds a bi-metal component which acts on the control device.

The manufacturer claims the following advantage for this arrangement : the relay follows the temperature of the warm point with a certain degree of delay, whilst the type above reproduces it almost exactly at all times.

The delay due to the bi-metal allows maximum use of the overload capacity of the transformer by following a somewhat flatter heating curve.

* * *

These equipments are relatively dear.

However, it may be stated, as an example, that the lowest price ([1]), which we have been advised, represents about 1.5 % of the cost of a « traction » type transformer, 3 000 kW - 36 kV HT - 3 kV D.C.

It is therefore to be assumed that the thermal reflector will be used on high power transformers with a high primary tension or on those installed into hot climate where it is necessary to make the most effective use of the heating capacity.

* * *

23. — **Excess voltages.**

This heading is designed to cover protection against excess voltages produced in the primary of transformers, i.e. in many cases at a very high voltage, 90 kV, 110 kV for example.

The *Deutsche B.* relies on an earth wire parallel to the feeders of the overhead primary lines.

In common with the *F.d. Stato,* they also count on increased insulation of the first turns of the primary windings (shock-absorbing coils).

The *B.-Congo K.* use excess voltage limiters comprising a resistance of semi-conducting material (thyrite) in series with a series of spark-gaps shunted by thyrite resistances

---

([1]) This price does not include the transformer for heating current.

and terminated by a pre-ionisation element.

The *C.F. Alpes B.*, *R.A.T. Paris* and *S.N.C. Vicinaux* in most of their installations dispense with protection.

The *S.N.C. Français* use primary tension limiters only in some early 90 kV sub-stations. Under 60 kV, they do not use apparatus of this kind.

The *Rhätische B.* has no transformer responsibility.

Other Administrations use various kinds of excess voltage cut-outs.

We consider that no HT excess voltage limiting device offers any really efficient protection and that it is of no advantage to instal them.

* * *

24. — Other incidents.

241. — *BUCHHOLZ RELAYS.*

It has been fitted to all transformers notified, which is a measure of its effectiveness. The principle of the apparatus may be recalled.

Any anomalous condition which is dangerous to the transformer results either in an arc, or in pronounced heating of the oil. These two phenomena cause a more or less pronounced discharge of gas. The relay (which is located in the pipe connecting the transformer tank to the oil reservoir) comprises two floats which each operate a contact.

The first comes into action with a moderate release of gas, and is used to sound the alarm. The second functions under a heavy flow of gas from the tank to the reservoir. It generally controls the transformer cut-out. The apparatus also signals a loss of oil such as an empty reservoir.

The *Deutsche B.* also consider the Buchholz as protection against heavy over-heating.

In the fully automatic installations of the *S.N.C. Vicinaux*, the action of the second contact « blocks » the converter group.

* * *

242. — *N.B.* : There is no report of protection against other incidents.

* * *

CHAPTER 3.

PROTECTION OF STATIC CONVERTERS.

31. — External and internal overloads and short circuits.

310. — *LIST OF REPLIES.*

We have grouped under the same heading, protection against overloads, external short circuits and internal short circuits including arc-backs.

This classification is justified, firstly by the similarity of the effects of the incidents and secondly by the fact that it is impossible to attribute an exclusive purpose against one or the other incident to any of the devices considered separately.

Table 310/1 summarises the replies of the Administrations. Table 310/2 completes it by giving the practice followed by experienced manufacturers.

In the latter table are also shown the protective gears for the whole *converter groups*. It is unnecessary to include these in Table 310/1 as these have been considered earlier.

* * *

311. — *COMMENTS.*

3111. — *Glass bulb rectifiers.*

Only the *S.N.C. Vicinaux* mentions glass bulbs. Reasons for this choice were noted in paragraph 4 of the introduction. The methods of protection shown in the table have proved adequate.

The opening of circuit breakers on feeder lines by a maximum intensity cathode relay has a particular advantage : by adjusting these relays to an intensity rather less than the overload capacity of the group imposed for the HT maximum relays, the opening of the HT circuit breakers is restricted to the minimum really necessary.

If the take-offs from the feeders are equipped with an automatic line-tester, everything is limited to the cutting out of one or more of the sections affected by the short circuit or excessive permanent overload.

* * *

3112. — *Metal tank rectifiers.*

§ 1. — *Sealed tanks replacing glass bulbs (S.N.C. Vicinaux).*

(Two reasons have led the *S.N.C. Vicinaux* to effect this substitution : the difficulty of obtaining bulbs during the last war and the necessity for increasing the available power in certain cases. In all, there are about 40 of these 378 kW tanks.)

With a slightly increased average output elementary protection is sufficient. On the other hand, for considerable loads with frequent peaks at short intervals, the *S.N.C. Vicinaux* have protected these tanks with quick acting maximum intensity anode relays and ultra-rapid reverse current cathode circuit breakers.

With a view to economy, they have also for some time used quick-acting maximum intensity anode relays with cathode contactor, which are mentioned under heading 3123.

§ 2. — *Other metal tank rectifiers.*

A. *External overloads and short circuits.*

With rare exceptions, reliance is placed on the protective gear of the primary converter group and the protective equipment for the intake points of direct current.

The manufacturers' practice in this respect is particularly significant.

Moreover, under headings 3121 and 3122, an examination is made of the methods of protection against non-accidental overloads of long duration.

B. *Internal short-circuits and arc-backs.*

Two conclusions emerge from an examination of table 310 :

1) the necessity for ultra-high speed reverse current cathode circuit breakers, at least for rectifiers of 1 000 kW and over; and this is so whether or not the rectifier has polarised grids as noted under 2).

Manufacturer No. 3, is however satisfied with the protection afforded by grids;

2) the extremely widespread use of polarised grid control to « block » the anodes.

The negative bias of the grids is obtained in various ways.

Use is often made of the extreme rapidity of action of the thyratrons to convey at the desired time a negative potential to the grid compared with that of the cathode.

It is not possible to make any discrimination as regards effectiveness of the various methods for obtaining the polarity of the grid : inversion of the difference in potential between tank and the cathode, relays fed by primary or neutral point current, etc. Each manufacturer advocates his own method and the user seldom has an opportunity for comparison.

Furthermore, it may be that grid control is not 100 % effective as stated by the *F.d. Stato.*

The British manufacturers whom we have consulted have also been rather reticent.

Finally, the provision of grids considerably increases the cost.

312. — *SOME SPECIAL METHODS OF PROTECTION AGAINST THESE INCIDENTS.*

3121. — *Limitation of the load by control grids.*

Certain groups of the *S.N.C.F.* (Paris-Lyons line), have retained voltage control with the basic purpose of limiting the load on the groups.

A fairly complex arrangement, making use of the electronic properties of valves, ensures the following functions :

1) progressive loading;

2) elimination of peak tension with no, or very small, load;

3) tension characteristic not influenced

by the equipment up to 150 % of nominal load;

4) beyond that, characteristic tension curve falls rapidly;

5) blocking of the rectifier at 300 % nominal load.

This compound arrangement has been abandoned in recent electrifications.

* * *

3122. — *Automatic addition of converter groups in relation to the load.*

This method has the same purpose as the preceding one.

It is reported in connection with integral automatic sub-stations such as those of the *S.N.C. Vicinaux.*

This solution postulates the use of special relays. If they are of good quality the result is completely satisfactory.

In certain *S.N.C. Vicinaux* s./stations, three converter groups of 630 kW each have been linked in this way. Any one of them can be selected, either as the basic group, as first stand-by group or as a second stand-by group. If one of the groups becomes defective, the one following it in the series takes its place.

Relays ensure the addition or elimination under loads and after time lags, adjustable within the following limits :

	Addition	*Elimination*
1st reserve	from 210 to 840 kW after 4 to 80 s.	from 165 to 670 kW after 1 to 17 min.
2nd reserve	from 630 to 2 500 kW after 4 to 80 s.	from 370 to 1 500kW after 1 to 17 min.

3123. — *Quick acting maximum intensity anode relays with cathode contactor.*

This methode resolves the following problem : to allow at the lowest cost the adaptation of rectifier protective gear when glass bulbs are replaced by sealed tanks.

It must be stressed that the *S.N.C. Vicinaux* have replaced 350 amp. bulbs by 600 amp. tanks. The problem was complicated by the fact that each group included two rectifier units fed by the same transformer.

Quick-acting relays replaced the anode fuses and one cathode contactor per tank was added, with auxiliary relays. The anode relays controlled the HT circuit-breaker of the group which in turn controlled the cathode contactors.

This method permits an economy of some 55 % of the cost which would be incurred in the purchase and installation of two UR cathode circuit-breakers of good quality.

So far they have given satisfactory results.

* * *

32. — **Other incidents.**

The method of protection differs very little for any other incidents.

We will describe the principles and, where they occur, examples of their application.

* * *

321. — *EXCESSIVE HEATING.*

The glass bulbs of the *S.N.C. Vicinaux* have no real protection against incidents. With regard to tank rectifiers one or more thermostats or thermometers ensure this role in three ways :

a) by giving an alarm signal;

b) by controlling the cooling system;

c) by cutting out the group.

One or more of these functions are fulfilled according to the circumstances.

The following are some applications :

1. — Protection of the most modern

sealed tank (air cooled) rectifiers of the *S.N.C. Vicinaux* :

1) the first thermostat, adjusted to 60° C controls the temperature of an anode. It engages the fan under this figure and disengages it about 54 to 57°;

2) the second thermostat, having the same purpose and adjusted to the same temperature, controls the temperature of the cathode;

3) the third thermostat, set at 70° C, also measuring the temperature of the cathode, cuts out the group by opening and blocking the HT circuit-breaker.

2. — On the *S.N.C.F.*, a thermostat set at 55° causes :

1) the alarm;

2) the tripping of a relay, with a timing of 10 minutes, which disengages the group and blocks the return of it to the circuit so long as the temperature of the tank remains above the normal value.

3. — On the *C.F. Algériens,* it is the temperature of the cooling water which is controlled.

The thermometer for controlling the cooling water of the tank, and that which controls the cooling water for the vacuum pump, have their respective contacts in parallel, the first with the « bad vacuum » contact of the equipment controlling the vacuum in the tank, and the other with an auxiliary contact for the protective gear for the water pump. The action of any of these contacts eliminates the group.

This particular precaution is justified in a hot climate.

* * *

322. — *DEFECTS IN THE COOLING SYSTEM.*

The information supplied on this subject is often not to the point. Some Administrations are content with the indirect protection afforded by the thermometric equipment dealt with under the previous heading. Certain others confine themselves to a warning of a fan stoppage. The *C.F. Maroc* report that, on two of their rectifiers « a device causes a stoppage in the case of an interruption in *the flow* of the cooling water ».

It would seem that the most frequent protection rests in the disengaging of the equipment protecting the motors of the cooling system; an auxiliary contact causes the opening of the HT circuit breaker of the group.

The *S.N.C. Vicinaux* use the latter method as well as protection by « ventilation flap ».

When the flap drops, although ventilation should be set up, the fall controls the opening of the HT circuit breaker of the group and the blocking of it.

Whatever the method of protection, the cutting out has a delay of 15 to 75 seconds.

It appears to us that the flap assures a more logical and more certain ventilation.

* * *

323. — *FAILURE OR DEFECT OF IGNITION OR EXCITATION.*

In general, the replies to this question state that these incidents operate a time-lag relay which causes the cutting out of the rectifier group.

The *S.N.C.F.* set the time lag at 15 seconds.

On the *S.N.C. Vicinaux,* this relay is energised by the excitation current and trips after an interval of 15 to 75 seconds. It does not, however, block the rectifier group; 3 to 5 successive reclosings of the HT circuit breaker are possible. In practice, this system has revealed no disadvantages.

* * *

324. — *INSUFFICIENT VACUUM.*

This obviously refers only to rectifiers with recuperative vacuum. Frequently, it is stated that an « electric vacuum motor » (*F.N. Milano*) or Wheatstone bridge is used, which in the case of a clearly insuf-

ficient vacuum puts the group temporarily out of service (but does not block it in certain installations).

The *C.F. Algériens* and the *S.N.C.F.* report that the action of the vacuum meter restores the group to service at the appropriate time.

In some cases, it is also used as an indicator.

The *S.N.C.B.* consider that experience has shown it is sufficient « to arrange for the constant operation of a high vacuum pump discharging into an intermediate reservoir, the primary vacuum pump being automatically put in action as soon as the gas pressure in the intermediate reservoir justifies it ».

Vacuum meters with Wheatstone bridge have not given satisfaction in the *S.N.C. Vicinaux* installations.

This Administration adopted the same practice as the S.N.C.B.

* * *

325. — *EXCESS VOLTAGES.*

We will consider under this heading tension-limiters connected either to the secondary bus-bars or to the anodes.

Their use is quite general, but the type is not always stated.

On the *S.N.C. Vicinaux* semi-conducting resistances are used.

The *S.N.C.F.* give the characteristics of their tension limiters (connected between the anodes and negative pole) :

nominal tension : 2 300 V;

striking tension : between 5 200 and 6 000 V;

discharge capacity : 100 amp. in 25 micro/seconds.

* * *

326. — *VARIOUS INCIDENTS.*

We will mention only the most characteristic of these protective arrangements.

3261. — *Earthing relays.*

Used by the *R.A.T. Paris* and the *S.N.C.F.* The latter Administration state that they are connected between the negative bus-bar and the metal framework of the equipment cubicles. In the case of the arc striking below 1 500 V DC on the control circuits, the group concerned is blocked.

3262. — *Thermostat for insufficient temperature in the rectifier.*

On the *S.N.C.F.* if the temperature of the tank is less than 25° C, a thermostat cuts out the group until the temperature is restored to this figure.

With the same idea, the *S.N.C. Vicinaux* in winter reheat glass bulbs before putting them into automatic daily service, by means of modern type electric radiators. A time switch controls the circuit for these heating appliances.

* * *

33. — **Note on automatic tension adjustment by grid control.**

Whilst grid control is often used as protection against overloads and/or short circuits (1) only two converters (*C.F. Maroc*) are reported where the grids act as tension regulators.

On the *S.N.C.F.* the use of grids for this purpose is tending to disappear.

On the other hand, the *Deutsche B.* has tried this method of regulation and is satisfied with it.

* * *

CHAPTER 4.

PROTECTION OF CONTACT LINES AND FEEDERS.

41. — **Constitution of the systems.**

41. — It is valueless to detail this constitution; the replies show that the type of protection chosen does not, in principle, depend on this.

(1) See headings 3112 and 3121.

It will however be of interest to deal with the particular points raised under the two following headings.

It may also be mentioned, as an item of information, that the *Deutsche B.* connects to the rail the positive line of the DC system, which is contrary to what is done by other Administrations.

* * *

411. — *EARTHING OF RUNNING RAILS.*

This is done on the *B.-Congo K.*, the *C.F. Algériens*, the *F.N. Milano*, the *C.F. Maroc* as well as by the *Deutsche B.*, which does not however indicate the method used.

The methods used are as follows :

B.-Congo K. : posts connected electrically to the rails, and earthed every fourth post, or about every 240 m (262 yards) on straight track.

C.F. Algériens : earth plate every 1 000 m (1 093 yards).

F.N. Milano : artisian wells.

C.F. Maroc : rails connected together and to a copper conductor of 50 mm² section connected to an earth plate every 65 m (71 yards).

* * *

412. — *CONSTITUTION OF FEEDERS.*

The almost exclusive use of non-insulated overhead feeders is noted, these being cheaper than insulated cables and easier to repair and replace. The operation of sub-stations in parallel also works in favour of this choice, since it may cause faults in feeders of long length.

The *S.N.C.F.* is replacing cables of older installations by overhead feeders. In most recent installations, insulated cables are used to connect sub-stations to the feeder points. Cables are laid in underground ducts. Their average length is only about 30 m (33 yards) and the maximum length 160 m (175 yards).

Except in large towns, the *S.N.C. Vicinaux* connects sub-stations to the contact wires by means of overhead feeders.

The *S.N.C.B.* and the *N.V. Nederl. S.* have insulated cables for feeders.

It should be noted that this refers to main line railways, which are able to lay their cables away from public places, which obviously facilitates maintenance.

Furthermore, the *S.N.C.B.* locates its feeder cables in concrete troughs at ground level along the line, as they also do with all other cables.

These troughs are made up of units about 50 cm (1′ 7 11/16″) long, provided with a cover plate and are able to accommodate 4 to 5 cables of 310 mm² section.

This method of laying is much cheaper than burying direct in the ground.

The average length of cables on the *S.N.C.B.* is 540 m (590 yards) and the maximum length 1 400 m (1 531 yards).

Cables on the *N.V. Nederl. S.* are buried. Average length : 80 m (87 yards); maximum length : 600 m (656 yards).

* * *

42. — **Overloads and short circuits.**

421. — *CIRCUIT BREAKERS AND ACCESSORIES* (1).

A. *Systems using AC.*

Deutsche B. : protection of contact lines is effected by a dual arrangement. The first, a « short-period » stage (Kurzstufe) comprise an impedance unit and an ultra-rapid directional relay. It operates in the space of about a half-cycle and closes the disengagement circuit in about 0.3 seconds The second component (Langstufe) works if the first does not operate. It has a delay of about 0.5 seconds. The « long-period » stage comprises a non-directional overcurrent relay with a time-lag independent of the intensity.

(1) No special protective gear is reported other than that relative to overloads, short circuits and voltage surges.

The circuit-breaker itself is of the ultra-rapid type.

B.-Congo K. : the circuit breaker on the transformer secondary ensures protection of the contact lines.

C.F. Alpes B. : no protection.

Rhätische B. : uses selective protection based on intensity and voltage. No details are given.

B. — *Systems using DC.*

Except on the *R.A.T. Paris,* ultra-rapid circuit-breakers are used, either exclusively or with the intention of doing so.

It therefore appears that despite a cost of 3 to 5 times that of an ordinary circuit breaker, this type has indisputable advantages.

In the great majority of cases, these ultra-rapid circuit-breakers open by the action of a magnetic flux caused by the main current and opposed to the magnetic flux of the excitation. These parts are thus also polarised.

The magnetic shunt renders them more sensitive to open short circuits. Powerful springs open the contacts which are fitted with spark arresters and an arcing horn device.

* * *

422. — *AUTOMATIC LINE TEST.*

4221. — *All feeder take-off gears of the following Administrations* include an automatic reclosure arrangement for the circuit breaker :

— *B.-Congo K.;*

— *C.F. Algériens;*

— *F.d. Stato;*

— *N.V. Nederl. S.*

The same applies to :

— existing *S.N.C.B.* sub-stations, excluding a substation where a manual resistance test of the line is made before reclosing the circuit breaker;

— the static converter sub-stations of the *S.N.C. Vicinaux* and most of the rotary converters or mixed sub-stations;

— the *S.N.C.F.* integral automatic substations and the older substations controlled from nearby centres;

— some feeder take-offs of the *F.N. Milano.*

4222. — *Factors governing the automatic reclosure of circuit breakers.*

a) Sometimes the only criterion is a *limited number of reclosures* within a given time. If this number is reached the circuit-breaker remains open.

This principle is applied, with the number limited to three :

— to feeder take-offs with automatic reclosure of the *F.N. Milano* and the *F.d. Stato;*

— most feeder take-offs with automatic reclosure of the *S.N.C.F.*

It is also used, with a single reclosure, in recent sub-stations of the *S.N.C.B.*

b) In all other cases where the circuit breaker recloses without intervention by the staff, the reclosing is subject to automatic testing of the electrical resistance of the line.

To do this, a control resistance, connected to the terminals of the circuit breaker is inserted when the breaker opens, in series with the line resistance (1). A potentiometric relay measures the resistance, either at the ends of the line resistance or at the ends of the control resistance.

In the equipment used by the *F.N. Milano,* however, and in a number of the *S.N.C. Vicinaux* pre-1940 installations, an amperemetric relay takes the place of the potentiometric relay, measuring the intensity of the current through the control circuit.

These relays cause the circuit breaker to

(1) This refers to the D.C. method. On the *B.-Congo. K.,* the principle is the same; the method takes into account the high alternating voltage of the system (25 kV 50 cycles).

reclose, after a certain time-lag, provided the line resistance is normal.

4223. — *Experience with equipment for automatic measurement of line resistance.*

The *S.N.C.F.* has not installed automatic line resistance testing in recent automatic or remote-controlled sub-stations.

Their experience has « shown that this arrangement offers, in practice, more drawbacks than advantages ».

The *S.N.C.B.* has not found it economical to equip new sub-stations with automatic resistance testing.

The numerous equipments of this type used by the *S.N.C. Vicinaux* have not given them any insurmountable trouble, and they even find them economically justified.

It may be that this difference of opinion can be attributed to the relatively low voltage at which the system is supplied.

However, this may be, the *S.N.C. Vicinaux* has generalised automatic testing for all static convertor group installations. The arrangement has actually been extended to rotary converter sub-stations wherever economic justification could be found.

They also equip each rotary converter with an amperemetric relay which controls the opening of all the circuit breakers on the feeders. This allows the maximum surge adjustment of the DC circuit breaker on the machine. The time-lag is adjusted to different values for closing each of the circuit-breakers on the feeders.

In this way, the sub-stations become almost completely automatic. The control staff can carry out other duties concurrently. Their role is confined to the normal starting and stopping and the infrequent attention necessitated by the opening of the HT circuit breakers of the DC circuit breakers on the machines.

* * *

43. — **Excess voltages.**

430. — *SUMMARY OF REPLIES.*

430. — The following table groups the replies in order of the voltage at the busbars of the intake points to the traction system. This tension « E » is shown in kV with a note on the number of cycles (Hz), where appropriate.

431. — *COMMENTS.*

It can be seen that lightning arrestors based on the properties of semi-conducting materials are predominant. The *S.N.C. Vicinaux* however still use a 4 micro F condensor shunted by a discharge resistance and connected between the positive pole and earth. Condensor and resistance are immersed in a synthetic non-inflammable liquid.

This choice is based on practical comparative trials to which the different models of lightning arrestors *a*, *b* and *c* were subjected.

This decision seems, moreover, to be confirmed by the extensive use of condensor lightning arrestors for the protection of vehicles (see table, app. 510) and heading 5112).

* * *

44. — **Parallel operation of sub-stations.**

440. — *GENERAL.*

1. *This practice is so wide spread* that it is sufficient to mention only those Administrations which do not use it : the *B.-Congo K.* and *C.F. Alpes B.* There are special reasons for these exceptions.

The *B.-Congo K.* spreads the sub-station transformers between the phases of the primary system (3 phase, 110 kV 50 cycles). A secondary phase from each transformer is obviously connected to the rails. Each transformer or group of transformers of a single sub-station feeds one section of the line. This implies the insulation of sections from each other.

The *C.F. Alpes B.* has no real protection (in the strict meaning) for its traction system.

2. *Parallel operation* ensures, all other things being equal :

1) a lower voltage drop and consequently a higher speed;

2) greater security of supply.

On the other hand, there is an increased probability of damage to the conductors following a fault remote from the supply

ADMINISTRATIONS	E	Hz	Cycles type of protection	Notes a.b.c. not co-existent
Systems using A. C.				
Deutsche B	16.5 24	16 2/3 50	cathode drop	at coupling points
B. Congo-K.	25	50	multiple subdivision spark extinguisher with semi-conducting resistances (resorbite) in series with air dessicator	in the catenary line
C.F. Alpes B.	16	16 2/3	—	no protection
Rhätische B.	11	16 2/3	See B. Congo K.	—

ADMINISTRATIONS	E	Cycles type of protection	Notes
Systems using D. C.			
A. — From 3 to 3.3 kV.			
S.N.C. Belges . . .	3.3	*a)* electrode pile of semi-conducting material (carbosial) separated by very small gaps.	at the beginning of long feeder cables, in sub-stations and sectioning posts
		b) spark gap in series with semi-conducting material (resorbite) shunted by an arc blow-out coil	— the three types are suitable — the first two are cheaper than the third
		c) capacitators	—

ADMINISTRATIONS	E	Cycles type of protection	Notes
C.F. Algériens . . .	3	see S.N.C.B. type b)	a type of lightning protector based on a similar principle but including a magnetic shunt to the spark gap operated by the discharge has frequently failed. It is gradually being replaced by the type opposite
C.F. Maroc	3.3	condenser	before 1940 : electrolytic lightning arrester. Discontinued during the war because of lack of material for replacement
F.N. Milano	3	spark gap in series with semi-conducting resistance (resorbite)	—
F. d. Stato	3.2	spark gap in series with condensor	—
B. — From 1.2 to 1.6 kV.			
Deutsche B.	1.2	see above	—
C.F. H.-Savoie . . .	1.55	electrolytic	—
R.A.T. Paris (Sceaux line.	1.5	electrolytic	Feeder take-offs.
S.N.C. Français . .	1.6	various types based on the semi-conducting properties of silicon carbides (resorbite, carbosial, thyrite, etc.).	*a)* Feeder take-offs *b)* On the line; in principle by lightning arresters. Trials « at certain places ». Efficiency not determined except for a line subject to a high isokeraunic level. Lightning arrestors every 500 m (547 yards).
N.V. Nederl. S. . .	1.55	*a)* semi-conducting resistance *b)* horns	*a)* feeders } good *b)* lines exposed to lightning } results

ADMINISTRATIONS	E	Cyclés type of protection	Notes
C. — About 0.6 kV.			
S.N.C. Vicinaux . .	0.63	*a)* two types of lightning arrestors similar to type *a)* S.N.C.B. *b)* spark-gap in series with semi-conducting resistance; arc blow-out coil *c)* 4 micro F condensor, shunted by discharge resistance of semi-conductor (thyrite)	1° at feeder take-offs in sub-stations 2° in principle every 1 000 m (1 093 yards) of line and positive feed points of signalling equipment (single track or roads) — see comments
R.A.T. Paris	0.6	no lightning protection	underground system

point. At least, this is so in theory.

In addition, a fault could affect a greater portion of the system by opening all the circuit-breakers liable to supply it. This causes traffic disturbances.

441. — *SPECIAL PROTECTIVE DEVICES FOR PARALLEL RUNNING*

4411. — *Rhätische B.* (already described).

This Administration uses a selective protection, based on the intensity and voltage.

4412. — *Sectioning between sub-stations.*

Circuit-breakers located in a so-called sectioning or coupling post situated about mid-way between sub-stations limit the portion of the system put of service by a fault in the line or feeders.

These posts are manually controlled or remotely controlled.

The *S.N.C.B.* (1) also rely on the fact that circuit-breakers are polarised. The diagram in figure 1 shows how the polarisation works.

Assuming a defect at A sufficient to open the circuit-breakers D_2 - D_3 - D_5. As a result of the polarisation D_1 - D_4 - D_6 do not open. It is sufficient to reclose D_5 to limit the stoppage to the section between D_2 and D_3.

4413. — *Interlocking of circuit-breakers.*

The *S.N.C.F.* on the other hand interlock the circuit-breakers of the take-offs feeding a single section. They thus seek to eliminate the possibility of loading a remote fault.

Interlocking is obtained by means of a specially allocated auxiliary circuit, where appropriate included in the telephone cable.

If a circuit-breaker trips, the circuit-breakers with which it is interlocked open also.

4414. — *Detector relay for short circuits.*

There is a type of relay designed to detect short circuits fed by a remote source of energy (electrically resistant faults). The designer has sought to provide equipment sensitive to sudden and continuous increases, as distinct from increases due to bearings (such as for example current increases due to the starting of motors).

It is contended that this condition can be

(1) And it would seem the *Deutsche B.* also : circuit-breakers with directional or polarised arrangements.

realised by determining the characteristics of the equipment in such a way that the effect of increased intensity « *di* » is preponderant in relation to the speed of increase : $\frac{di}{dt}$ (1).

The essential parts of the equipment are :

1) a transformer, non-saturated, the winding fed by the current to be controlled constituting the primary;

2) a maximum intensity relay, very sensitive, connected to the secondary. Two means are provided to ensure operation adequate for the output characteristics :

a) modification of the time constant of the transformer secondary circuit;

b) adjustment of the secondary intensity above which the relay operates.

The designer claims that this apparatus can « detect short-circuits or faults » at least 2 to 7 times less than normal peak current. « Normal current » covers the current for setting the circuit-breakers.

The *S.N.C.B.* is very satisfied with tests which they have made with this type of equipment.

The *R.A.T. Paris* uses it also. It covers very long sections.

The *S.N.C. Vicinaux* has one apparatus of this type. Operation appears good. The device however needs adjustment of such fineness that it must be modified to meet traffic conditions. The cost is high.

Notes. — The *Deutsche B.* intended to send a diagram illustrating the measures they apply by reason of the parallel operation of sub-stations. Unfortunately, this diagram has not arrived.

* * *

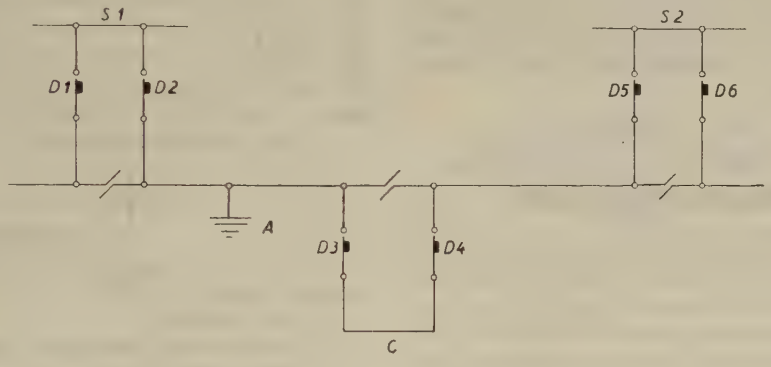


Fig. 1.

S : sub-station; D : circuit-breaker;
C : sectioning post; A : line fault.

442. — *ADMINISTRATIONS EMPLOYING NO SPECIAL PROTECTIVE DEVICES FOR PARALLEL OPERATION OF SUB-STATIONS.*

The *C.F. Algériens* have continuous feeders all along the system with line sectioning every 5 km (about 3 miles). A defective section can thus easily be bridged.

The *C.F. Maroc* and the *N.V. Nederl. S.* use no special protection.

The *S.N.C. Vicinaux* have used parallel operation for many years. They have tested various apparatus and devices designed to detect electrically resistant faults. All have shown themselves more of a drawback than an advantage. It is concluded that the advantages of parallel running largely compensate the cost of the various faults in conductors attributable to short circuits remote

(1) See P. BRANCHU : 1) *Revue Générale de l'Electricité,* Vol. 53, No. 3, March 1949, and 2) *Bulletin de la Société Française des Electriciens,* 7th series, Vol. 1, Feb. 1951.

from supply points and that the provision of costly and special contingency protection can be dispensed with.

* * *

CHAPTER 5.

PROTECTION OF ELECTRICALLY-OPERATED MOTOR VEHICLES.

51. — General or principal protection.

510. — *LIST OF REPLIES.*

Except where otherwise stated, the devices covered by table 510 cover the whole circuit. When the action of a relay is not described, it controls the main cut-out equipment.

511. — *COMMENTS.*

5111. — *Overloads and short circuits.*

Main disconnecting equipment.

A. *Systems using AC.*

Nothing worthy of note has been reported.

B. *Systems using DC.*

First category : voltages about 3 kV.

An ultra-rapid circuit-breaker with one or more overload or maximum relays is fitted to the great majority of motor units.

It appears that some Administrations consider it advantageous to take certain precautions when opening the circuit. This is the case on the *C.F. Algériens* (for CC class locomotives) and on the :

F.d. Stato : line contactor combined with protective separator.

Relays controlling the contactors C provide protection against overloads. These insert the rheostat before opening these contactors.

The protective separator is designed to mitigate defective operation of the line contactor; for example in the case of a fault in the rheostat or the contactor.

The device comprises two elements in parallel : a circuit-breaker D and a short circuit fuse F inserted in the traction circuit.

In normal running, the current is divided between the two units by reason of the inverse resistance factor. In the case of a short-circuit, appropriate setting of a general maximum relay trips the circuit-breaker D which earths the traction circuit and connects the short circuit to the full line tension.

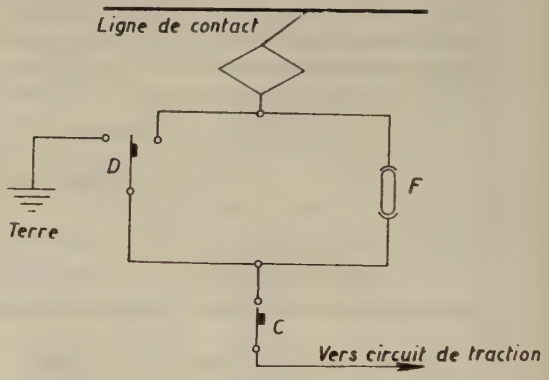


Fig. 2.

terre : earth;
C : line contactor;
D : circuit-breaker with earth contact;
F : short circuit fuse.

This therefore provides :

a) suppression of arcs which would be set up in the equipment;

b) clean and instantaneous cutting of the short circuit current by fusion of F.

The combination of circuit-breaker and fuse offers several advantages :

1) an exact assessment can be made of the value of the over-current at which the circuit-breaker D will trip; a good quality relay provides precise control, whilst the fuse blows at any dangerous current intensity value;

2) only a fraction of the normal current passes through the fuse F. It is, of course, difficult to make fuses capable of carrying any considerable intensity of current at a high voltage;

3) the circuit-breaker D, being in parallel with the fuse F, trips at the voltage existing at the ends of F, that is under

some ten volts or so. It can thus be cheaper and smaller than a UR type.

The circuit-breaker/fuse assembly is located in the vehicle roof.

Second category : tensions of about 1.5 kV and blow.

A UR circuit breaker is used for the highest tensions and powers. In other cases, ordinary circuit-breakers or even fuses appear to be sufficient.

The *N.V. Nederl. S.* combine the two methods, mainly on motor coaches; circuit-breakers are provided against overloads and fuses against short-circuits.

Note. — The *S.N.C.F.* is tending to discard overload relays; they consider that the power of the motors is sufficient to cause slipping of the driving wheels before the intensity reaches a dangerous value.

5112. — *Excess voltages.*

A. *Systems using AC.*

Lightning arrestors of the spark-gap and semi-conducting resistor type only are noted.

B. *Systems using DC.*

Condensor type lightning arrestors are most used.

The *S.N.C.F.* employ several types of lightning arrestors, which they use for vehicles and for protection of feeders from substations. All these are based on the same principle : property of various substances (silicon carbide) having an electrical resistance of inverse proportion to the voltage applied.

According to the *S.N.C.F.* the different applications are about the same in value. None of them is completely perfect.

5113. — *Other incidents.*

To cater for a voltage drop or complete disappearance, the following Administrations insert special relays :

Deutsche B., S.N.C.B., C.F. Algériens, S.N.C.F., N.V. Nederl. S.

These relays have various names.

On the *S.N.C.B.*, they cause the starter equipment to return to the starting position.

* * *

52. — **Protection of secondary circuits.**

These are the circuits for compressors, fans, lighting, heating, etc.

With AC and DC of about 3 kV, mention has been made only of overload relays controlling the main circuit-breaker. No general conclusion can be made for the remainder.

The *N.V. Nederl. S.* has supplied complete diagrams of the protective arrangements for its motor vehicles.

Two diagrams are included in Appendices 52/1 and 52/2. One of these refers to a locomotive and one to a motor coach set, both of recent construction.

* * *

CHAPTER 6.

REGENERATIVE BRAKING.

60. — General remarks on regenerative braking.

In this respect, the Administrations replying can be listed in four classes.

It may be useful to show, in each case, the total length of the system, the nominal supply tension and the number of motor vehicles equipped for this method.

First class : employing regenerative braking.

1) *Deutsche B.* — DC system 90 km (56 miles), 1.2 kV, 43 Bo' Bo' locomotives (i.e. all motor units);

2) *Rhätische B.* — 277 km (162 miles), 11 kV, 16 2/3 cycles, 10 Bo' Bo' locomotives (10 out of 25);

3) *C.F. Algériens* — 310 km (192 miles), 3 kV DC (CC locomotives number not stated). — (Note : The more recent BB locomotives have not regenerative braking.);

4) *S.N.C.F.* — 4 014 km (2 493 miles), 1.6 kV, DC, still use this method of energy regeneration on « certain lines or sections of lines electrified before *1942*, where substations have rotary converters in suitable places ». The number of motor vehicles is not stated.

On lines recently electrified, or in course of electrification the *S.N.C.F.* has discontinued this method of braking, particularly

as the corresponding sub-stations have only static converters;

5) *C.F. Maroc* — 761 km (473 miles), 3.2 kV, DC, all motor units, i.e. 53 locomotives of various types;

6) *F.d. Stato* — 4 320 km (2 684 miles), 3.2 kV, DC, all motor units, about 630.

Certain B'oB'o locomotives, type E424 are fitted for regenerative braking, and have « series-independent » compound excitation motors.

E424 type locomotives work light passenger trains over level country and (with suitable transmission ratio) freight trains over down-graded lines.

2nd class : regeneration projected.

The *S.N.C.B.* — 164 km (104 miles), 3.3 kV, DC, intends to order 83 Bo Bo locomotives with regenerative braking equipment. These machines will work on the Brussels-Arlon line, three-quarters of which has down-gradients of more than 10 $^{0}/_{00}$ and also on the Brussels-Charleroi line, where there are gradients of 13 $^{0}/_{00}$. (Note. — At the end of 1955 the *S.N.C.B.* will have in service some 75 locomotives and some 160 motor coaches built since 1945 without regenerative brake equipment).

3rd class : regeneration abandoned.

The *R.A.T. Paris* — 169 km (106 miles), 0.6 kV and 20 km (12 miles), 1.5 kV : has made several trials but has not adopted this type of braking. The *R.A.T.P.* has 1 160 motor vehicles for 0.6 kV and 102 for 1.5 kV DC.

4th class :

All other Administrations do not use regenerative braking and do not expect to adopt it.

The *B.-Congo K.* (207 km [128 miles], 25 kV, 50 cycles — 11 Bo Bo locomotives) has decided, after investigation, that regenerative braking has no benefit to offer them, even though their lines include a gradient of 12.5 $^{0}/_{00}$ over 30 km (19 miles).

* * *

In total, the use of this method of braking is confined to some special cases. The comments of the *S.N.C.F.* which are reproduced below give an excellent summary of the question :

« Regenerative braking is advantageous only when lines include, in relation to their total length, a high percentage of long, sharp gradients on which it constitutes an efficient means of restraint whilst avoiding rapid wear of brake shoes, it allows at the same time a certain economy of electrical energy. »

Additionally : « The equipment used for this purpose, both in sub-stations and on rolling stock, has no special features. At the same time, it requires, particularly on locomotives, fairly costly auxiliary equipment, the operation of which calls for some skill on the part of the crew. Its operation is nevertheless very satisfactory and safe, when all measures are taken to ensure that the coupling to the line of the traction motors working as separately excited generators is effected in suitable conditions of tension and the brakes are applied normally in the event of disconnection or loss of line tension. »

These relevant considerations provide for the two following headings to be dealt with briefly.

* * *

61. — Special protection necessitated by regenerative braking.

611. — *AT SUB-STATIONS.*

A. *AC.*

The *Rhätische B.* does not mention any special protection.

B. *DC.*

§ 1. — *Rotary groups.*

C.F. Algériens : 7 motor generator groups;

C.F. Maroc : 16 ditto.

The synchronous motor has compound excitation. The compound winding is energised by current from a shunt in the main circuit of the DC generator. A reverse current contactor maintains the direction of the current in the compound winding

TABLE 0/3 — SYSTEMS USING D.C.

ADMINISTRATION	ELECTRIFIED SYSTEM: Type	Length km.	Supply voltage (kV). At the busbars	On the line: Average	On the line: Minimum	Number of feeder stations	STATIC TRANSFORMERS: Numbers	Number of primary phases	Capacity in kW (KVA)	Protection against: overloads	short-circuits	over-heating	voltage surges	various incidents	Buchholz
Deutsche B.	Secondary	90	1.2	1.1	0.9	*	21	3	3 700			○	·	○	
S.N.C. Belges	Main line	164	3.3	2.95	1.8	5	14	3	3 000	^	^	^	^	○	^
S.N.C. Luxembg.	secondary	1 370	0.63	0.6	0.45	110	19 8 4 1 18 59 1 20 16 7 2 14 18	3 3 3 3 3 3 3 3 3 3 3 3 3	300 to 380 550 800 1 050 340 to 440 350 to 600 600 250 to 500 450 to 600 570 765 450 to 600 600 to 870	× × × × × × × × × × × × ×	× × × × × × × × × × × × ×	○ ○ ○ ○ × × × × × × × × ×	× ○ ○ ○ × × × × × × × × ×	○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○	○ ○ ○ ○ × × × × × × × × ×
C.F. Algériens		310	3		2.7	3 2	7 2	3 3	3 000 2 000	× ×	× ×	× ×	× ×	○ ○	○ ○
C.F. H. Savoie		49	1.55	1.40	1.16	2	2	3	348	×	×	×	×	○	○
R.A.T. Paris	*a* urban	169	0.6	0.55	0.35	19	47 13 36	3 3 3	500 1 000 1 500	× ×	× ×	× ×	○ ○	○ ○	× ×
						11	8		3 000		·	·	○	○	·
	b suburban	20	1.5	1.35	1.20	2	8	3	2 000				○	○	
S.N.C. Français	interurban	4 014	1.6	1.35	1.25	3 18 2 10 3 4 56 6 4 34 2 20 31	8 46 2 24 6 6 110 16 9 61 6 20 72	3 3 3 3 3 3 3 3 3 3 3 3 3	1 500 750 1 000 1 000 1 500 1 500 2 000 1 200 1 500 2 000 2 750 4 000 4 000	○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○	× × × × × × × × × × × × ×	× × × × × × × × × × × × ×	○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○	○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○	× × × × × × × × × × × × ×
		203	0.6 to 0.85			8	24 (3)		1 000 to 1 500	○	×	×	○	○	×
						21	35 (3)	6	450 to 2 080	○	×	×	○	○	×
C.F. Maroc	interurban	761	3.3	2.9	1.8 (1)	8 1 1 2	16 2 1 2	3 3 3 3	1 570 1 160 1 805 2 700	× ×	× ×	× ×	× ×	○ ○ ○ ○	× ×
F.N. Milano		161	3.0		2.7	4	6 1	3 3	2 850 2 230	·	·	·	·	· (1) · (1)	·
F. d. Stato	interurban	4 320	3.2	3.0	2.8	89 3	186 6	3 3	2 800 5 100	·	·	·	○		·
N.V. Nederl. S.	interurban	1 350	1.53	1.43	1.23	1 3 70	4 9 114	3 3 3	1 000 1 200 1 800	× ×	× ×	○ ×	× ×	○ ○	× ×
TOTALS							1 257		from 250 kW to 4 000 kW						

CONVERTERS: Rotary — MG = Motor generating set; Cm = Rotary converters: Type	N	kW	PH
Deutsche B.			
S.N.C. Belges			
S.N.C. Luxembg.	Cm Cm Cm Cm	19 8 4 1	350 500 750 1 000	6 6 6 6
C.F. Algériens	MG	7	2 750	
C.F. H. Savoie	MG	2	250	
R.A.T. Paris	Cm Cm	47 13	1 500 3 000	6 6
	Cm	8 · 2	2 · 1 000 (1)	6
S.N.C. Français	Cm Cm Cm Cm Cm Cm Cm	8×2 46 2×2 24 6×2 6 110×2	2×750 (1) 750 2×1 000 (1) 1 000 2×750 (1) 1 500 2×2 000 (1)	6 6 6 6 6 6 6
	Cm	24 (3)	1 000 to 1 500	
C.F. Maroc	MG	16	1 000	6
F.N. Milano				
F. d. Stato				
N.V. Nederl. S.	MG	2	1 000	3
TOTALS	Cm MG	460 27	from 350 kW to 3 000 kW from 250 kW to 2 750 kW	

CONVERTERS: Static — Metal tank — Multianode — With pump Cooling — water cooled	N	kW	PH
Deutsche B.			
S.N.C. Belges	6	3 000	6
S.N.C. Luxembg.	2	535	6
C.F. Algériens	2	2 000	12
C.F. H. Savoie			
R.A.T. Paris	1 9 26	540 ; 540 (2) 1 200 1 500	6 6 6
S.N.C. Français	16 9 61 6 20 72	1 200 1 500 2 000 2 750 2 000+2 000 (2) 4 000	6 6 6 6 6 6
	36	450 (3) to 2 080	6
C.F. Maroc	2 2	1 000 1 000	6 6
F.N. Milano	6	2 000	12
F. d. Stato	159 6	2 000 3 600	6 6
N.V. Nederl. S.	2 9 27 7	1 000 1 000 1 000 1 000	6 6 6 6
TOTALS	486	from 450 kW to 3 600 kW	

CONVERTERS: Static — Metal tank — Multianode — With pump Cooling — air cooled	N	kW	PH
Deutsche B.	21	2 880	6
S.N.C. Belges	8	3 000	6
S.N.C. Luxembg.	7	504	6
C.F. Algériens			
R.A.T. Paris			
S.N.C. Français	air or water cooled		
C.F. Maroc	2 · 2	1 000 (2)	3
F.N. Milano	1	2 000	6
F. d. Stato	27	2 000	6
N.V. Nederl. S.	36	1 200	6
TOTALS	104	from 504 kW to 3 000 kW	

CONVERTERS: Static — Metal tank — Multianode — Sealed air cooled	N	kW	PH
Deutsche B.			
S.N.C. Belges			
S.N.C. Luxembg.	1 21 16 13 18	250+250 (2) 378 378+378 (2) 504 630	6 6 6 6 6
C.F. Algériens			
R.A.T. Paris			
S.N.C. Français			
C.F. Maroc			
F.N. Milano			
F. d. Stato			
N.V. Nederl. S.	34	1 200	6
TOTALS	103	from 250 kW to 1 200 kW	

CONVERTERS: Static — Metal tank — Single anode (ignitrons)	N	kW	PH
Deutsche B.			
S.N.C. Belges			
S.N.C. Luxembg.			
C.F. Algériens			
R.A.T. Paris			
S.N.C. Français			
C.F. Maroc			
F.N. Milano			
F. d. Stato			
N.V. Nederl. S.	10	1 000	6
TOTALS	10	1 000 kW	

CONVERTERS: Static — Glass bulb	N	kW	PH
Deutsche B.			
S.N.C. Belges			
S.N.C. Luxembg.	18 59	220 220+220 (2)	6 6
C.F. Algériens			
R.A.T. Paris			
S.N.C. Français			
C.F. Maroc			
F.N. Milano			
F. d. Stato			
N.V. Nederl. S.			
TOTALS	77	220 kW	

PROTECTION AGAINST	overloads	track short circuits	internal short circuit and arc backs (*)	overheating	cooling system faults	excitation failure	lack of vacuum	voltage surges	other incidents
Deutsche B.	×	×							○ (1)
S.N.C. Belges	×	×							× (1)
S.N.C. Luxembg.	×	×		○		×	○	×	○
C.F. Algériens	×	×	○				○		○
R.A.T. Paris	×	×						○	○
S.N.C. Français	×	×		×		×	×	✓	○
C.F. Maroc	×	×	○	×				×	○ (3)
F.N. Milano	○								○
F. d. Stato									
N.V. Nederl. S.	×	×	○	○	○	○	○	×	○
TOTALS									

NOTES
(*) and back-fires
(1) Reverse and reverse current (2) Two rectifiers in parallel per group
(1) 2 static converters in series (2) 2 rectifiers in parallel per group (3) Limit value
(1) 2 static converters in series (2) 2 rectifiers in parallel per group (3) Limit value (4) Return for insulation test at the tank
(1) Min. permissible for locomotives (2) 2 trimonic rectifiers in series in pairs of tubes
(1) Cooling system fault time delayed

whether the group is regenerating or not. The *C.F. Algériens* state that this contactor is controlled by polarised relay.

The protective elements offer no particular advantages.

§ 2. — *Static converter groups.*

None of the converter groups reported in the answers to the questionnaire is equipped for regeneration.

The *F.d. Stato* some years ago carried out operating tests with regeneration at certain sub-stations with static converter groups. Their opinion is :

« The trials gave very satisfactory results, but regeneration was not adopted because it was not expedient. »

The other Administrations regenerating or intending to regenerate by braking limit themselves to regeneration between vehicles.

* * *

612. — *SPECIAL DEVICES REQUIRED ON VEHICLES OWING TO THEIR TYPE OF BRAKING.*

We shall confine ourselves to a summary of the replies received :

Deutsche B.

Combined rheostatic and regenerative brake, protected by « brake current guards » (Bremsstromwächter).

Rhätische B.

« Oerlikon series », regenerative brake system.

Appendix 612 contains a diagram of the principle of this system and a diagram of its application to Bo Bo locomotives 605-610 of the *Rhätische B.*

A complete survey of the question appeared in the *Oerlikon Bulletin,* Nos. 283 and 284 (April to August 1950).

C.F. Algériens.

Regeneration equipment :

— one « traction regeneration » commutator;

— one no-voltage relay controlling the change from « traction » to « regeneration » for a regenerated current equal to about 50 amp. and « in the reverse direction for an intensity of practically « nothing »;

— one « no regeneration » relay acting when the regeneration current is cancelled. All regeneration circuits are cut and compressed air brakes are brought into action;

— one differential relay acting when the tension produced by the motors reaches the tension of the line; a main contactor closes up and the regeneration current is established;

— isolating valves between the triple valve and the brake cylinder; fed by the « traction-regeneration » commutator in the « regeneration » position, they isolate the brake cylinders;

— blow off valves connected to the main pipe of the automatic brake, which they operate « as soon as they are no longer excited ». These valves are installed in each driving cabin.

C.F. Maroc.

— one voltage relay allowing regenerative coupling when the tension produced by the motors is higher than the line tension;

— one over-voltage relay suppresses regeneration in the case of a dangerous rise of tension;

— one return-current relay.

F.d. Stato.

(On E424 class B'o B'o locomotives with « independent series » compound excitation motors) :

— one maximum voltage relay (set to 4 200 V) in front of the motors and behind the starting rheostat;

— one maximum excitation current relay; in the independent excitation circuit, sensitive to the intensity value $\left\langle \frac{di}{dt} \right\rangle$; acts in the event of a short circuit on the line, even though remote from the motor vehicle;

— one reverse-current relay : amperemetric relay in the motor circuit preventing any operation not compatible with regenerative running;

— one special rheostat for independent excitation of the traction motors.

TA

ADMINISTRATION	PRIMARY INSTALLATIO						
	POWER STATIONS		GENERATORS				
	Hydroelectric number	Thermal number	Number	Periodicity	Power kVA	R.p.m.	Nominal tension kV
1) *Deutsche B.* *a)*	5		1	16 2/3	20 000	250	6.3
			8	»	10 650 to 12 000	166 2/3 to 250	6.6 to 6.3
			4	»	1 600	250	1.5
		2	1	»	6 800	500	6.6
			3	»	12 500 to 16 000	1 000	6.3
b)		1	2	25	10 875 to 14 125	1 500	6.3
			2	25	5 600	1 500	6.3
			1	25	1 670	1 500	6.3
3) *C.F. Alpes Bern.*	2			16 2/3			16

TA

TRACTION SYSTE

ADMINIS-TRATION	ELECTRIFIED SYSTEMS							
	TYPE	Length km	SUPPLY CURRENT					No. of suppl station
			No. of phases	Perio-dicity	Tension in kV			
					At busbars	On the line		
						average	minimum	
Deutsche B. *a)*	Main line	1 576	1	16 2/3	16.5	15	12	16
b)	Main line	85	2	50	24	20	16	1
B. Congo-K.	Colonial	207	1	50	25	20.5	17	4
Rhätische B.	Secondary	277	1	16 2/3	11	10.5	8.5	3

ENERATORS AND TRANSFORMERS

	TRANSFORMERS										NOTES
	Periodicity	Power kVA	Transforming ratio kV	Method of cooling	Protection against: overloads	short circuits	overheating (1)	voltage surges	cooling system defects	Buchholz	(1) The *Deutsche B.* consider the Buchholz relays to be protection against overheating.
	16 2/3	2 000	6.6/124		×	×	O	×	O	×	
	»	10 650 to 12 000	6.9/122.5 to 6.6/123.5		×	×	O	×	O	×	
	»	1 600 to 3 000	1.5/16.4		×	×	O	×	O	×	
	»	8 500	6.6/122.4		×	×	O	×	O	×	
	»	16 200	6.6/115.5 to 6.3/122		×	×	O	×	O	×	
	25	1 800	6.3/32		×	×	O	×	O	×	
	25	667 to 867	6.3/32		×	×	O	×	O	×	
					(2)	(2)	(2)	(2)	(2)	(2)	(2) No protection

NG A.C.

TRANSFORMERS (TRACTION)								NOTES
umbers	Power kW	PROTECTION AGAINST: Overloads	Short circuits	Overheating (2)	Voltage surges (1)	Cooling system defects	Buchholz	(1) The *Deutsche B.* considers the Buchholz relays to be protection against overheating
37	5 000 to 7 000	×	×	×	×	O	×	(2) On certain transformers (Tauber plungers)
4	1 600 to 3 000	×	×	O	×	O	×	
2	1 500	×	×	O	×	O	×	
2	6 500	×	×	O	×	O	×	
10	6 000	×	×	×	×	O	×	

TABLE 1. — Protect

	ADMINISTRATION	*Deutsche Bahn*		*C.F. Algériens*	
a	Tension	110 kV	30 kV	5.5 kV	90 kV
b	No. of phases	single	single	3 phase	
c	Frequency	16 2/3 Hz	25 Hz	50 Hz	
d	Short circuit capacity at the generating station or the distributing station . . .	Proportional to the nominal power and inversely proportional to the short-circuit tension percentage of the transformers		No generating station	
e	ditto at each sub-station			at 3 substations 750 MVA the other 3 unknown	
f	Earthing of neutral point	Except in 2 cases (see *fc)* neutral point isolated			
	fa) by resistance			by resistance	
	fb) by reactance				
	fc) by Paterson coil	in two feeder stations			

primary equipment.

R.A.T. Paris	*S.N.C. Français*	*F. d. Stato*	*N.V. Nederl. S*
500 V	90 or 60 kV	130-150 or 60 kV	10 kV in exceptional cases 25 kV
phase	3 phase	3 phase	3 phase
Hz	50 Hz	50 Hz	50 Hz
ıe circuit-breakers of e supply system are not ilway owned	No information	Determined by the short circuit tension of the transformers, which average 5 to 6%	250 MVA
0 MVA per H.T. cable	Max. 1 200 MVA Min. 300 MVA	ditto, 7 to 12%	250 MVA
nil	90 kV system : direct earthing; 60 kV system : 150 ohms homopolar impedance coil	No	mostly : No

TABLE 1. — Protec

	ADMINISTRATION		*Deutsche Bahn*	*C.F. Algériens*
g	Generating station or distribution station : Protective characteristics	*ga)* at busbars	Quick acting (0.2 sec) circuit breaker installed as coupling between the two sets of busbars, fitted with impedance relays	see *d*
		gb) at H.T. distribution feeders	Selective protection dependent upon the apparent resistance (Scheinwiederstand)	see *d*
h	Feeder substations : Protective characteristics	*ha)* H.T. incoming feeders	see *gb*	Selective impedance rela (BBC)
		hb) busbars	Circuit-breaker coupling between two sets of busbars. This breaker is tripped by an impedance relay	A tripolar max. intensi relay A tripolar differential rel
j	Settings and timings of protective devices under *g* and *h*.		for *ga* : 0.2 sec for *gb* : 0.2 sec for *hb* : 0.6 sec	for *ha* : In = 5A settin between 2/3 In. and 20 I 0.5 to 2 secs for *hb* : no indicatio
k	Pilot wires :			
	Effect of a fault on these wires. . . .		No	No
	Devices fitted to indicate their condition			

rimary equipment *(continued)*.

R.A.T. Paris	*S.N.C. Français*	*F. de Stato*	*N.V. Nederl. S.*
d	No protection	H.T. circuit breakers with instantaneous and timelag max. intensity relays	not railway-owned
d	Paris-Lyons : BBC distance relay : see *j*		max. intensity relay
T. circuit-breakers	see *gb*	as *g*	1 differential intensity relay and 1 directional relay
protection	No protection		max. intensity relay
metal-covered cable : 5 A/mm²; for non-tal covered cable : A/mm²; for machines × In. tting times : rotary nverter : 0 sec; rectifier sec	0.1 sec. for short circuit between start and 3/4 of line; 0.7 sec for remainder of line	time-lag : 1.5 In 4 to 1 sec instantaneous 3 In	for *gb* : 450 A : 1.5 sec; for *ha* : 200 A : 0.5 sec (differential relays) for *hb* : 450 A : 1 sec
nil	yes Increased time of opening at one end of the line, if the short circuit occurs in the first or last quarter of the line. Ohmmeter	No	No

TABLE 310/1. — STATIC CONVERTE

ADMINISTRATION	Tension at the busbars	PROTECTION OF STAT (Overloads
		PROTECTION AGAINST OVERLOADS AND EXTERNAL SHORT CIRCUITS
Deutsche B. 1	1.2 kV	1° Ultra-rapid cathode circuit-breakers (see col. 2). with max relay set to $\frac{di}{dt}$; 2° Lock-out grids (see col. 2) polarised by relays adjusted to max
S.N.C. Belges 5	3.3 kV	see col. 2.
S.N.C. Vicinaux 6	0.63 kV	*A.* Glass bulbs: *a.* cathode max. relay controlling : *a)* H.T. circuit breaker *b)* feeder circuit breakers; *b.* 1. anode relays (see col. 2) 2. cathode max. relays controlling H.T. circuit breaker
		B. Metal tank rectifiers: § 1. Rectifiers similar to the glass bulbs (see heading 3172). *a.* cathode max. relay controlling : *a)* H.T. circuit breaker *b)* feeder circuit breakers; *b.* no proper protection; *c.* anode relay of col 2; *d.* ditto; § 2. Other rectifiers : no proper protection

ection against overloads and internal and external short circuits.

NVERTERS.
t circuits)

	PROTECTION AGAINST INTERNAL SHORT CIRCUITS
1°	Ultra-rapid polarised reverse current cathode circuit-breaker
2°	Anode lock-out grids, polarised by return-current relays (see col. 1.).
1°	Anode lock-out grids polarised by : *a.* amperemetric relay *b.* amperemetric relay and thyratron *c.* dynamo and thyratron controlled by tank-cathode potential
2°	Ultra-rapid reverse current cathode circuit breaker
a.	Anode fuses
b.	anode max. relays controlling H.T. circuit breaker
	Anode fuses
	U.R. circuit breaker, reverse current, controlling H.T. circuit-breaker and vice-versa
	Quick acting anode max. relays controlling H.T. circuit-breaker
1°	Quick acting anode max. relays controlling H.T. circuit-breaker
2°	*a.* U.R. reverse current circuit-breaker controlling H.T. circuit-breaker and vice-versa *b.* Cathode contactor controlled by H.T. circuit breaker (see heading 3123)
a.	Anode fuses
b.	U.R. reverse-current cathode circuit-breaker controlling H.T. circuit-breaker

TABLE 310/1. — STATIC CONVERTE

ADMINISTRATION	Tension at the busbars	PROTECTION (Overloads PROTECTION AGAINST OVERLOADS AND EXTERNAL SHORT CIRCUITS
C.F. Algériens 7	3 kV	Reciprocal control of H.T. and UR cathode circuit-breaker
R.A.T. Paris 9	0.6 kV	« Negative circuit-breaker »
S.N.C. Français 10	1.6 kV	*a.* Required to control power supplied *b.* No proper protection
C.F. Maroc 11	3.3 kV	No proper protection
F.N. Milano 12	3 kV	No proper protection
F. d. Stato 13	3.2 kV	U.R. cathode circuit-breaker, with max. relay set at 2 × intensit
N.V.Nederl. S. 14	1.53 kV	No proper protection

Legend : Items marked 1, 2, 3 are installed together
Items marked *a*, *b*, *c*, *d* are alternative arrangements
U.R. = quick acting apparatus

tection against overloads and internal and external short circuits *(continued)*.

ATIC CONVERTERS rt circuits)	
	PROTECTION AGAINST INTERNAL SHORT CIRCUITS
U.R. cathode circuit-breaker, with polarised reverse current relay	
1° 2°	anode lock-out grid See col. 1.
1°	Anode lock-out grids, polarised by : *a.* rectifier bridge . . . . . } controlled by : *b.* rotary group. . . . . } *a.* magnetic amplifiers *b.* U.R. relays fed by intensity transformers mounted on : *a.* H.T. feed *b.* anode circuits
2°	U.R. reverse-current cathode circuit-breaker
1° 2°	U.R. cathode circuit-breaker Anode lock-out grids, polarised by : *a.* release of auxiliary rectifier *b.* U.R. relay
1° 2°	Cathode circuit-breaker Anode lock-out grids, polarised by intensity relays, energised by intensity reducers in the central star of the transformer secondary. If the arc is not suppressed by the action of the grids, the same relays trip the H.T. and cathode circuit-breakers.
1°	Anode lock-out grids, polarised by : *a.* overload current in anode feed system; *b.* inversion of difference in tank-cathode potential
2°	Cathode circuit breaker (see col. 1.) with reverse current relay
1° 2°	U.R. reverse current cathode circuit breaker Anode lock-out grids

TABLE 310/2. — **Static converter groups. Protection aga**

Firm	H.T. PROTECTION OF CONVERTER GROUPS	PROTECTION OF CO (overloads PROTECTION AGAINST OVERLOADS AND EXTERNAL SHORT CIRCUITS
1	1° *A.* For a high power group thermal reflector relay *B.* For smaller groups : thermal relays : against overloads 2° Instantaneous max. relays against external short circuits. These relays can be temporarily shunted when the group is connected.	See column 1
2	Direct H.T. relays with time-lag dependent on (or independent of) the overload (or indirect max. intensity relays).	1° See col. 1 2° *A.* Glass bulbs: *a.* 1° Fuses of col. 3. 2° Cathode max. relay, timed inverse to intensity *b.* Quick-acting anode relays of col. *B.* Multi-anodes metal rectifiers: § 1. Sealed: *a)* Quick-acting anode relay with cathode contactor *b)* No proper protectio § 2. Pumped: 1) Anode lock-out grids, p larised by thyratron co trolled by relay fed b primary intensity reduce 2) Max. relays controllin the cathode circuit-breake see col. 3 *C.* Ignitrons *a.* cathode circuit-breaker, max. or controlle by H.T. circuit-breaker *b.* See col. 1 and 3

ads and internal and external short circuits.

RTERS THEMSELVES t circuits) PROTECTION AGAINST INTERNAL SHORT CIRCUITS	REMARKS
U.R. reverse current cathode circuit-breaker, controlling the H.T. circuit-breaker and vice-versa For grid controlled rectifiers : grids lock out anodes, polarised by dynamo controlled by thyratron, the grid of which is released by inversion of the tank-cathode potential Grids indispensable when E $\geqslant$ 1 000 V D.C. or when power $\geqslant$ 1 500 hW.	
See col. 1 Anode fuses Quick acting anode relays controlling H.T. circuit breaker *a.* Quick acting anode relays controlling H.T. circuit-breaker which controls cathode contactor *b.* U.R. reverse current cathode circuit-breaker Reciprocal control of H.T. circuit-breaker and cathode contactor or circuit-breaker Lock-out grids U.R. reverse current cathode circuit-breaker (1) U.R. reverse current anode circuit breaker (2) Anodes locked out by *a)* polarised grids *b)* suppression of ignitron feed	(1) For high powers or when it is required that the total load should not be cut in the event of arc-back (2) For normal powers and when the total load can be cut without disadvantage

TABLE 310/2. — **Static converter groups. Protection ag**

Firm	H.T. PROTECTION OF CONVERTER GROUPS	PROTECTION (overloads PROTECTION AGAINST OVERLOADS AND EXTERNAL SHORT CIRCUITS
3	Three-phase indirect thermal relay, time-lagged, max. intensity with fast electro-magnetic device against short circuits	1° Overloads, see col. 1 2° External short circuits 1° see col. 1 2° *a)* see *a* col. 3 *b)* see *b* col. 3
4	*a.* Instantaneous relay, set at 4 to 4 × In. *b.* Preferably : induction disc relay or pivotted armature with separate time-lag relay.	1° See col. 1. 2° Tank thermostats.
5	*a.* 1) Three-phase indirect relay, 2 over current and one « earth fault » relay. 2) Two indirect time-lag relays with instantaneous adjustment at 5 × In. *b.* 1) Two direct relays, delayed, with instantaneous trip at 5 × In. 2) One direct relay with instantaneous trip (earth fault)	See col. 1
6	Direct max. relays, instantaneous action at 3 or 4 × In. The total interruption time must be < 0.1 sec	1° See col. 1 2° Thermostat on anode plate 3° For a single group : U.R. max. cathode circuit-breaker
7	1° Direct or indirect thermal relay 2° Two max. intensity relays	1° See col. 1 2° With grid control : anode lock-out by grids polarised by a dynamo, the polarity of which is inverted by a relay connected to two intensity reducers on the primary. The use of two grids per anode, one positive normally in use the other negatively polarised in the event of a fault, is recommended

ads and internal and external short circuits *(continued)*.

NVERTERS THEMSELVES t circuits) PROTECTION AGAINST INTERNAL SHORT CIRCUITS	REMARKS
In rectifiers $\leqslant$ 700 A, quick acting anode fuses In rectifiers $\geqslant$ 1 000 A, anode lock-out grids, polarised by : *a)* primary A.C. calibrated relay, if protection is not selective; *b)* selective, differential or reverse current relay, if the protection must be selective (1)	(1) relay comprises two coils, fed by currents proportional to 2 primary phases, one element fed by cathode current and one holding magnet
Anode fuses (1) U.R. reverse current cathode circuit-breaker	(1) In the opinion of the manufacturer, fuses are solely for protection against internal short circuits
Anode fuses (in certain cases) (1) Protection recommended : U.R. reverse current cathode circuit breakers In addition (at the customer's request) anode lock-out grids (2)	(1) See note above (2) Manufacturer's remark : « Grids are expensive and need complex apparatus; they cut out only the defective current component fed by the transformer »
If several groups in parallel, U.R. reverse current cathode circuit-breaker For { short circuit power of primary supply > 250 MA : 1° Anode lock-oud grids 2° U.R. reverse current cathode circuit-breaker. service voltage > 1 500 V : idem (1 and 2) several units in parallel : idem (1 and 2)	
Without grids : 1° See col. 1, 2 2° U.R. reverse current cathode circuit-breaker. With grids : 1° See col. 1, 2 2° See col. 2, 2 3° U.R. reverse current cathode circuit breaker	KEY : U.R. = ultra rapid apparatus 1, 2, 3, co-existant protection *a*, *b*, *c*, alternative methods

TABLE 510. — Motor ve

ADMINISTRATION	Busbar voltage	MOTOR UNITS					To hou rat (H.P kV
		Number	Type	DESIGNATION by the Administration	DESIGNATION standard	Total number of motors	k
1) *Deutsche B.*	A.C. various	5	Locomotives	E10	Bo′Bo′	4	3 2
		34	»	E18	1′Do1′	4	3 0
		4	»	E19	1′Do1′	4	4 0
		118	»	E44	Bo′Bo′	4	2 2
		(1)	»	E50	Co′Co′	4	appr 4 2
		77	»	E94	Co′Co′	4	3 3
		3	Motor coaches	ET11	Bo′2′+2′Bo′	4	1 0
		19	»	ET25	Bo′2′+2′Bo′	4	9
		(1)	»	ET30	Bo′2′+2′2′ +2′Bo′	4	1 7
		6	»	ET32	Bo′2′+2′Bo′	4	1 1
		23	»	ET65	Bo′Bo′	4	9
	1.2 kV D.C.	43	»	ET171	Bo′Bo′	4	5
2) *B. Congo-K.*	25 kV 50 Hz	12	Locomotives		BoBo	4	H.P 1 6
3) *C.F. Alpes B.*	15 kV 16 2/3 Hz		Locomotives		1C′oC′o1	6	H.P 6 0
			»		B′oB′o	4	4 0
4) *Rhätische B.*	11 kV 16 2/3 Hz	15	Locomotives		CC	2	H.P 1 2
		10	»		BoBo	4	1 6
5) *S.N.C. Belges* (1)	3.3 kV D.C.	20	Locomotives	BoBo 101	BoBo	4	H.P 2 2
		3	»	BoBo 120	BoBo	4	2 7
		3	»	BoBo 121	BoBo	4	2 8
		50	»	BoBo 122	BoBo	4	2 7
		12	Motor coaches	1935		8	2 1
		8	»	1939		4	1 0
		1	»	1946		4	1 0
		25	»	1950		4	1 0
		1	»	1951 (1)		4	1 0
		15	»	1953		4	1 0
		79	»	1954		4	1 0
		38	»	1955		4	1 0

eral or principal protection.

GENERAL PROTECTION AGAINST				Key : Abbreviations : see table 310
OVERLOADS AND SHORT CIRCUITS			EXCESS VOLTAGE	REMARKS
Principal cut-out arrangement		Main relays		
Name	Special features			
Main circuit breaker (Hauptschalter)		— in H.T. circuit — over current — time lag	Protective devices between intake and main circuit breaker *a)* with semi-conducting resistance *b)* with cathode drop	(1) Vehicles under construction. Number not stated
.T. circuit-breaker			Lightning arrester; type not stated	
Main circuit-breaker ompressed air type		Over-current	○	
Main H.T. circuit-breaker		Over-current controls main H.T. circuit-breaker	○	
Circuit-breaker	Ultra-rapid	1. over-current per group of 2 motors; 2. differential relay	Condensers Between contact line and mass As near as possible to the pantograph	(1) Motor units in service or on order. The motor coaches are designated by the actual year when they were or are intended to be put into service
Main switch	Electro-pneumatic contactor	1. general over current; 2. overcurrent per group of 2 motors. These relays break the supply to the contactor electro-valve		
Main fuse				

TABLE 510. — **Motor vehicles.**

ADMINISTRATION	Busbar voltage	MOTOR UNITS					
		Number	Type	DESIGNATION		Total number of motors	Total hourly rating (H.P. or kW)
				by the Administration	standard		
6) *S.N.C. Vicinaux*	0.63 kV D.C.	419 (1)	Tramway motor vehicles	normal bogie	BoBo	4	H.P. 264
		21 (1)	»	light bogie	BoBo	4	264
		70 (1)	»	N	BB	2	130
		25 (1)	»	P.C.C.	BoBo	4	220
7) *C.F. Algériens*	3 kV D.C.		Locomotives	6AE	CC	6	H.P. 2 400
				4AE	BB	4	1 750
			Locomotives	4AE	BB		
8) *C.F.H. Savoie*	1.55 kV D.C.	7	Passenger motor coaches		BoBo	4	H.P. 388
		2	Brake van motor coaches		BoBo	4	388
9) *R.A.T. Paris*	A 0.6 kV	596	Motor units		BoBo	4	H.P. 700
	CC	564	»			2	350
	B 1.5 kV D.C.		»			2	500
10) *S.N.C. Français*	1.6 kV D.C.	136 (1)	Locomotives	BB	BoBo	4	H.P. 3 200
		35 (1)	»	2D2	2D2	4	5 560
		43 (1)	»	CC	CoCo	6	5 060
		54 (1)	Motor coaches	Z	BoBo	4	1 450

ral or principal protection *(continued)*.

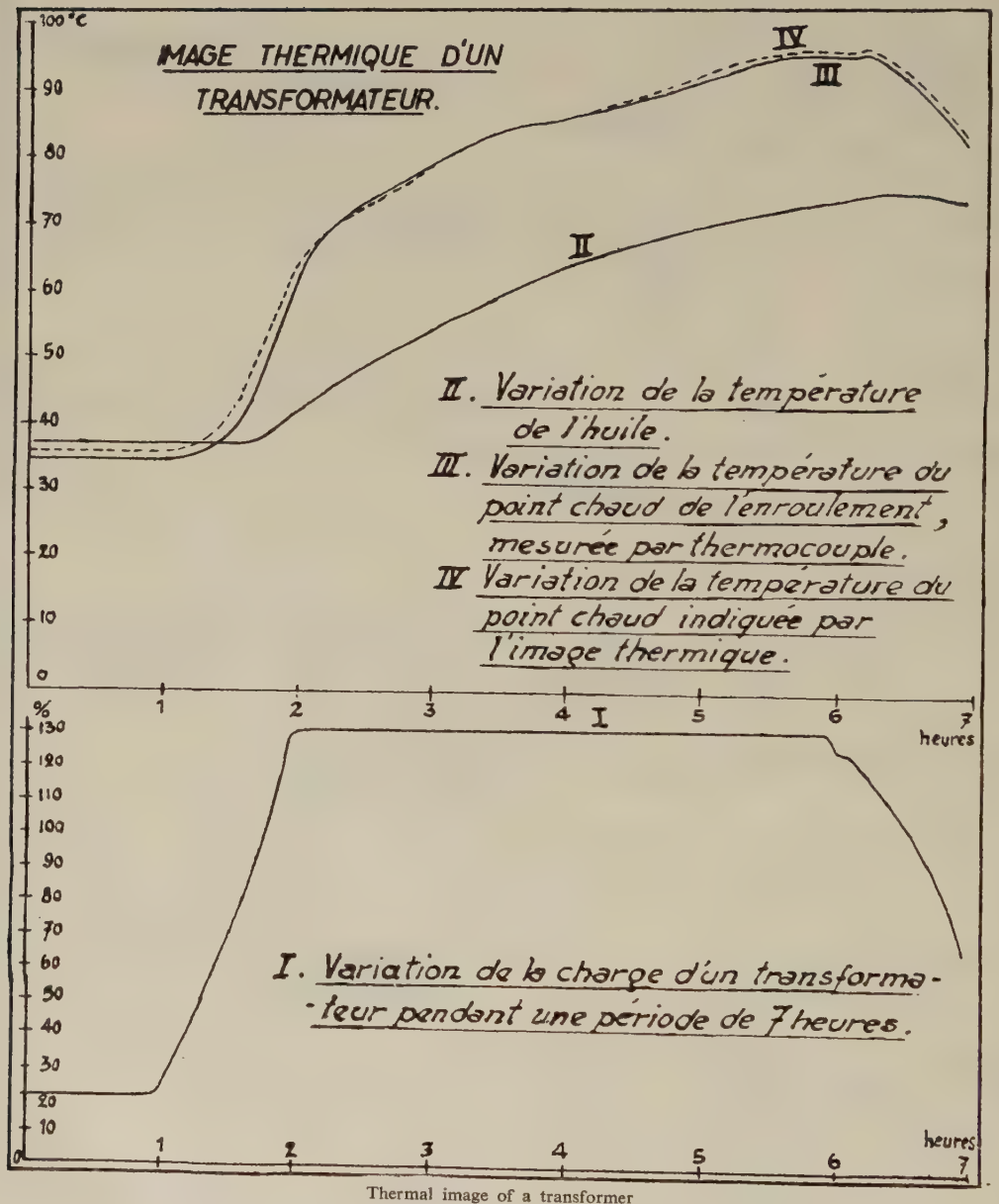
GENERAL PROTECTION AGAINST				REMARKS
OVERLOADS AND SHORT CIRCUITS			EXCESS VOLTAGE	
Principal cut-out arrangement		Main relays		
Name	Special features			
Circuit-breaker	Maximum		Horn-type lightning arresters (2) Capacitator lightning arresters (see table 430)	(1) Recent or modernised tramway type vehicles (2) Being replaced by capacitators
Line cut-out		General over current	Horn-type lightning arresters (2) Capacitator lightning arresters (see table 430)	
rcuit breaker	U.R. — maximum — inductive shunt — polarised — insertion of a limiting resistance	1 relay per pair of motors	(1) Self inductive coil on locomotive roof (2) Spark-gap arrestors in series with resistance (resorbite) shunted by an arc blow-out coil	
rcuit breaker	U.R. — inductive shunt — closed and held by electro-valve	1 max. relay per pair of motors 1 differential relay		
Circuit breaker	maximum	Overload relays	1 lightning arrester per pantograph : semi - conducting resistance	
neral fuse	Jeumont « marine » type Silver tipped leaves in silicon-packed cartridge		Lightning arrester (type not stated)	
ne cut-outs		Overload relay differential relay	Lightning arrester (type not stated)	
rcuit breaker	U.R. with max. device		1 Lightning arrester per pantograph — semi-conducting resistance (see table 430)	(1) Driving vehicles of recent construction

ADMINISTRATION	Busbar voltage	MOTOR UNITS					
		Number	Type	DESIGNATION		Total number of motors	Total hourly rating (H.P. kW)
				by the Administration	standard		
							H.P.
11) *C.F. Maroc*	3.3 kV	7	Locomotives	E200	BoBo	4	1 450
	D.C.	10	»	E500	BoBo	4	1 340
		12	»	E600	BoBo	4	1 450
		14	»	E700	BoBo	4	1 800
		10	Motor coaches	Z.C.D.	BoBo	4	700
							H.P.
12) *F.N. Milano*	3 kV	10	Locomotives	600-610	BoBo	4	1 400
	D.C.	24	Motor coaches	700-750	BoBo	4	700
		3	»	730	BoBo	4	1 040
		7	»	740	BoBo	4	1 040
							kW
13) *F. d. Stato*	3.2 kV	242	Locomotives	E428	2′B′o+B′o2′	8	2 700
	D.C.	114	»	E636	B′oB′oB′o	6	2 380
		158	»	E424	B′oB′o	4	1 580
		30	Electric motor coaches	Ale883	B′oB′o	4	760
		68	»	Ale840	B′oB′o	4	760
		16	Express articulated electrotrains	ETR200	B′o(A1)(1A)B′o	6	1 140
		2	»	ETR300	B′o2′B′o+B′o2′ 2′B′o+B′o 2′B′o	12	2 280
							Current (A)
14) *N.V. Nederl. S.*	1.53 kV	10	Locomotives		(1A) Bo(1A)	8	660
	D.C.	50	»		Bo′Bo′	4	840
		25	»		Co′Co′	6	685
		10	»		Co′Co′	6	840
		6	Motor coaches		Bo′2′Bo′	4	320
		5	»		Bo′2′Bo′	4	320
		19	»		Bo′2′2′Bo′	4	320
		13	»		Bo′2′2′Bo′	4	320
		10	»		Bo′2′+2′Bo′	4	320
		25	Sets		Bo′Bo′+2′2′ +2′2′+Bo′Bo′	8	320
		19	»		Bo′2′2′Bo′ +Bo′2′Bo′	8	320
		64	»		Bo′2′Bo′ +Bo′2′Bo′	8	320
		79	»		Bo′2′Bo′	4	320

al or principal protection *(continued)*.

GENERAL PROTECTION AGAINST				REMARKS
OVERLOADS AND SHORT CIRCUITS			EXCESS VOLTAGE	
Principal cut-out arrangement		Main relays		
Name	Special features			
Circuit-breaker	U.R. Maximum	Several overload relays Several differential relays	Capacitator lightning arrester	
Valvola » H.T. ircuit-breaker Ditto ircuit-breaker	U.R. calibrated at 1 200 A U.R. calibrated at 450 A U.R. calibrated at 400 A U.R. calibrated at 800 A	Circuit-breaker Electro-magnetic max. relay » »	Electrolytic and « dry »	
Line contactor isolator	Rheostat inserted before cut-out see heading 5 111 I	1 general max. relay 1 max. relay per pair of motors	1) (On a limited number of machines) 1 μf condensor against shock wave 2) Spinterometer on each brush-holder against commutator arcing	(1) Should act against excess voltage — see heading 5 112
ircuit-breaker Circuit-breaker General fuse	*a)* 3 000 A. *b)* 4 000 A. (1 per pantograph) (generally 600 A)	1 overload relay	Capacitator lightning arrester ditto	

APPENDIX 222.



Thermal image of a transformer

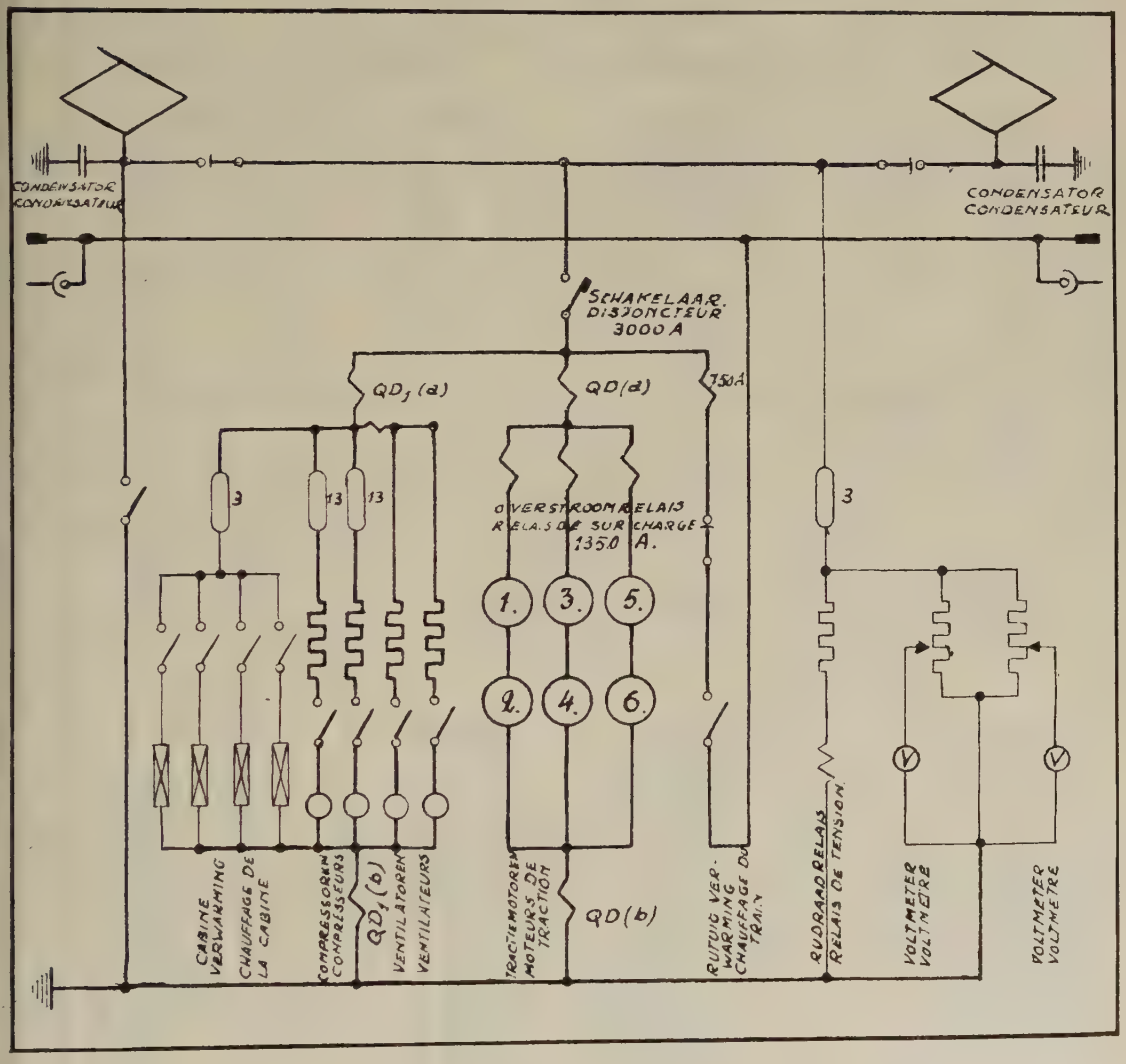
Explanation of French terms :

I. Variation of transformer load during a period of 7 hours
heures = hours.
II. Variation of oil temperature.
III. Variation of temperature of hot spot of the winding, measured by thermocouple.
IV. Variation of temperature of hot spot indicated by thermal reflector.

APPENDIX 52/1.

Electric locomotive Co'-Co' type of 1952-53.

Current distribution.

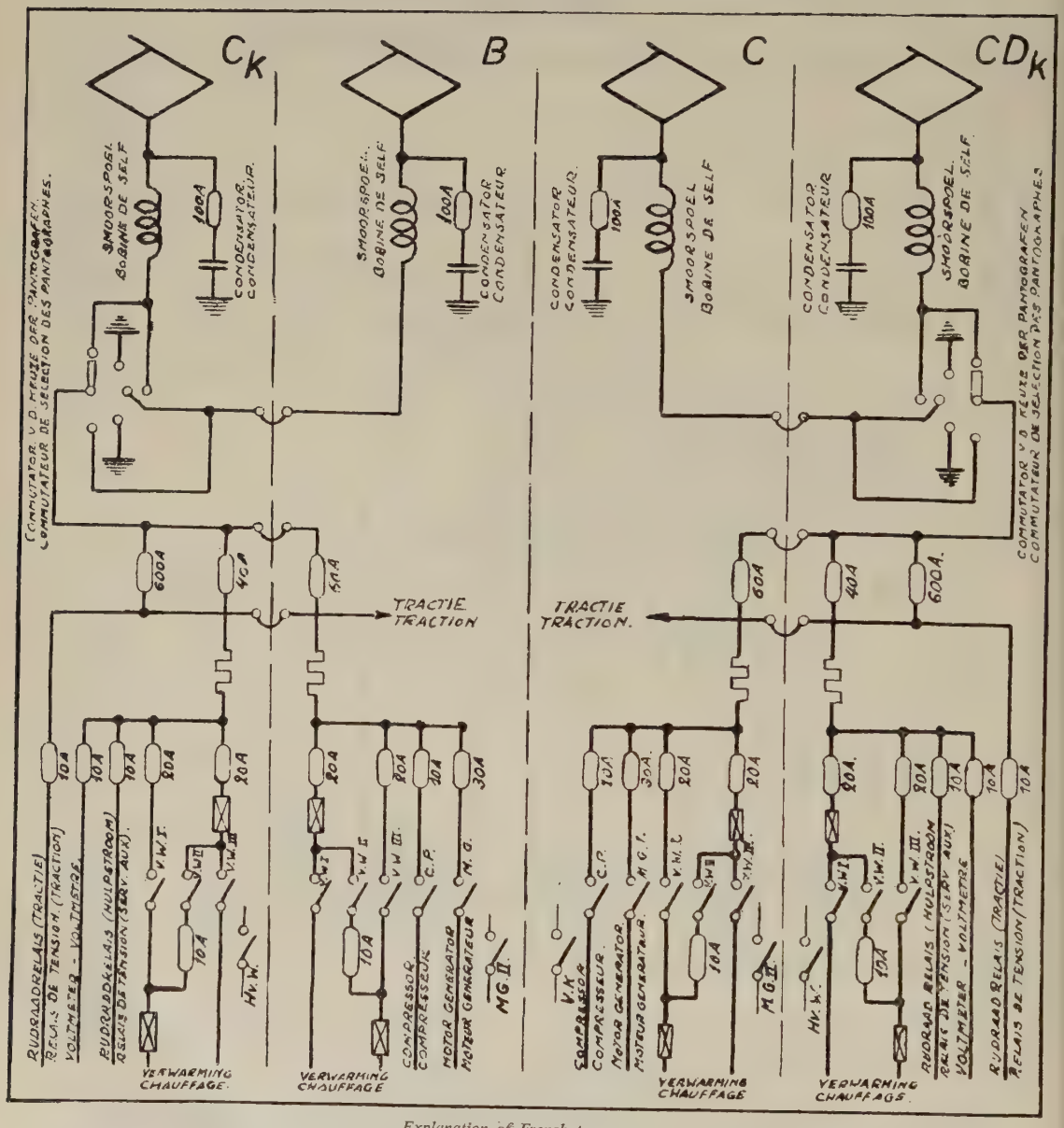


Explanation of French terms :

Condensateur = Condenser. — Disjoncteur 3 000 A = Circuit-breaker 3 000 A. — Relais de surcharge 1 350 A = Overload relay 1 350 A. — Chauffage de la cabine = Cab heating. — Compresseurs = Compressors. — Ventilateurs = Fans. — Moteurs de traction = Traction motors. — Chauffage du train = Train heating. — Relais de tension = Voltage relays. — Voltmètre = Voltmeter.

APPENDIX 52/2.

Electric motor coach sets, type Bo'2'Bo' + Bo'2'Bo'. Nos. 641-648, 650-705.
Current distribution.

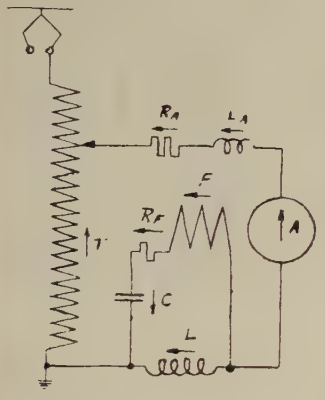


Explanation of French terms :

Chauffage = Heating. — Relais de tension (traction) = Voltage relays (traction). — Voltmètre = Voltmeter. — Relais de tension (serv. aux.) = Voltage relays (aux. serv.). — Commutateur de sélection des pantographes = Pantograph selector. — Bobine de self = Self-induction coil. — Traction = Traction. — Condensateur = Condenser.

APPENDIX 612.

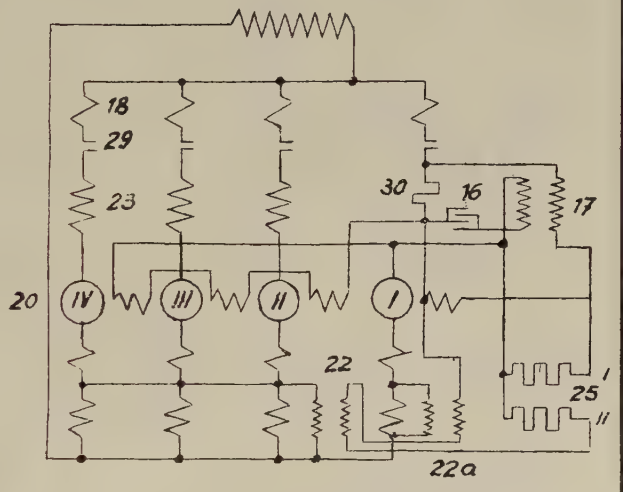
REGENERATIVE BRAKING
OERLIKON
SERIES SYSTEM
DIAGRAM OF PRINCIPLES



KEY

A. Armature.
F. Excitation.
Ra. Armature resistance.
Rf. Excitation resistance.
La. Armature induction.
L. Reactance.
T. Transformer.

APPLICATION TO BoBo LOCOMOTIVES
605-610
RHAETIAN RAILWAY
(RHÄTISCHE BAHN)



KEY

16. *Regeneration condenser.*
17. *Excitation transformer.*
18. *Intensity reducers for traction motor current.*
20. *Traction motors.*
22. *Inductive shunts for auxiliary poles of motors II-IV*
22a. *Inductive shunts for auxiliary poles of motor I.*
23. *Brake windings.*
25. *I-II. Excitation resistances.*
29. *Motor cut-out relays.*
30. *Anti-compound resistance.*

CONTENTS

CONTENTS *(continued.)*

[656 .1]

INTERNATIONAL RAILWAY CONGRESS ASSOCIATION

16th. SESSION (LONDON, 1954).

QUESTION 9.

Railway participation in road transport undertakings.

REPORT

(Austria, Belgium and Colony, Bulgaria, Czechoslovakia, France and French Union, Western Germany, Greece, Hungary, Italy, Luxemburg, Poland, Portugal and Colonies, Rumania, Spain, Switzerland, Syria, Turkey and Yugoslavia),

by Dr. G. Dreyer,

Secrétaire Général adjoint des Chemins de fer Fédéraux suisses.

INTRODUCTION.

A detailed questionnaire in connection with Question 9, drawn up in collaboration with the Reporter for English speaking countries, Mr. Tissot van Patot, Chief of the Cabinet and General Policy Division of the Netherlands Railways, was sent to 65 Administrations in European and overseas countries. Half of these Administrations replied, amongst them in particular the chief European Administrations. However, in view of the nature and subject of the question, only a small number of Administrations were able to supply sufficient information to form the basis of a report. The subject covered is new and unusual. Several Administrations declared that they were extremely interested in this problem, but were not able to make any contribution to the debate thereon. In most countries, co-ordination of the methods of transport is being vigorously investigated and the question of the participation of railway administrations in road transport undertakings is being studied. In including this subject on the agenda of the Congress, a definite want is clearly being met. We hope that it will be possible to arrive at certain conclusions.

Here we would like to express our gratitude to the Administrations who were good enough to reply in a detailed fashion to our questionnaire and thus facilitated the preparation of the report (1).

(1) List of abbreviations :

SNCF. — French National Railways.

SCETA. — Société de Contrôle et d'Exploitation des Transports Auxiliaires.

DB. — Deutsche Bundesbahn (German Federal Railways).

FS. — Ferrovie dello Stato (Italian State Railways).

SNCB. — Belgian National Railways.

SNCV. — Belgian National Light Railways.

OeBB. — Oesterreichische Bundesbahnen (Austrian Federal Railways).

CFF. — Swiss Federal Railways.

SNCL. — Luxemburg National Railways.

RENFE. — Red Nacional de los Ferrocariles Españoles.

We have taken the liberty of completing here and there the data supplied by the administrations in their replies to the questionnaire with information we have been able to collect from other sources, in particular in the reports of the administrations published each year in the UIC Bulletin, as well as in the periodic reports of UIC on « competition and co-operation between railway and motor in inland and international passenger and freight traffic ».

I. POSSIBILITIES OF PARTICIPATION.

1. *Are your railways authorised to operate road transport services? If so, are they allowed to participate in road transport undertakings either directly or by contract and to what extent? (Full liberty or restricted.)*

It is interesting to see that most Railway administrations are, in principle, authorised to carry out road transport. This fact is of primary importance, since it throws into relief a general state of affairs which up to now was only imperfectly appreciated from the isolated data available.

However, this right to carry out road transport varies from country to country in its foundations, its definition, its scope and its content.

It may be due to the negative attitude of the laws: when they do not expressly forbid the railways to carry out road transport, it can be concluded that they are authorised to do so (SNCF, DB, etc.).

It may on the contrary be the result of an express provision of the law (FS, CFF). In *Italy*, a law (R.D.L. No. 1575 of the 21st December 1931) allows the FS Administration to operate passenger and freight services to replace or complete railway services. This right, though confirmed by the law, is however limited in its extent. In *Switzerland*, the CFF can alter the type of operating in order to adapt it to traffic requirements and the exigencies of the national economy (art. 4, law on the CFF of the 23rd June 1944). This provision therefore is concerned above all with substitute services. In both cases, a preliminary authorisation of the Ministry of Transport is necessary.

In *Greece*, in virtue of a law of 1946, the operating of road services parallel to the railway is conceded to private undertakings as well as to the railway concerned, according to a certain percentage:

— in the case of roads parallel to the Greek State Railways, 55 % to private undertakings and 45 % to the railway, with the exception of the road from Salonica to Cavalla and Xanthi, where the percentage is fixed at 80 and 20 % respectively;

— in the case of roads parallel to the Peloponesian, Thessalian, and North-West Greece Railways, 60 % to the private undertakings and 40 % to the private railways.

However, the exercise of this right, its scope and its extent, generally depend further either on the statutes of the railway company, or on the laws, decrees, regulations or orders relating to the coordination of transport or road transport and the system of licences in vigour in this connection to which the railway administrations are in principle subject.

These clauses define, and often restrict the extent and scope of the right to operate road services. For example in *Belgium*, the Ministry of Communications in 1946 forbade the SNCB to carry out road freight services from one end of the run to the other. The activities of the SNCB in this connection are therefore limited to the terminal operations (door to door services, services to secondary stations from the centre stations, etc.). In *Germany*, the DB is bound by the clauses of the law on the transport of persons and that on the transport of freight by road. In the case of passenger traffic, the DB must get the authorisation of the competent Ministries of the « Länder » to carry out regular or occasional services, either by a separate statutory organization (en régie) or by means of vehicles owned by a third party.

In the case of freight traffic, the law limits the number of lorries which the railway can run on its own behalf (3.5 % of the vehicles licensed for long distance freight traffic), but the DB can, without restriction, charter or rent vehicles belonging to a third part. In *France,* the regulations of the SNCF allow the undertaking to operate a line or section of line by other methods of transport than railway working and over a different route, but in actual fact administrative practice limits the right of the SNCF to operate road services under separate statutory organization (en régie) (*).

It should be noted however that certain railways do not appear to come under legal, statutory or administrative limitations as regards road transport. This is the case in particular with countries now being developed, where methods of transport are very limited (Cambodia, Congo, French West Africa, etc.). In Europe, the railway has only very rarely profited by its faculty of carrying out road transport to develop in a methodical manner a network of road services, so as to assure that it held the leading position in this field and to achieve in a satisfactory way the coordination of all overland transport (GFM). The latter case can be considered as a typical example of the results obtained by a logical and persevering policy. But these efforts date back to many years and the results remain limited to a very restricted territory.

On the other hand, a fairly general tendency will be noticed to give the railway a right of priority or preference to operate all road services running parallel to the railway or intended to replace railway services (substitute lines) or to complete them. This right of priority is very marked in particular in *Spain* where the RENFE has the preferential right to operate road services parallel to the railway or leading to its lines and to collect taxes ad hoc from services conceded to private firms. It is more varied and less absolute in *Italy, Germany, Belgium* and *France.* However, it only covers, in the case of passenger traffic, regular services. In *Switzerland,* the legal prescriptions applicable to regular passenger services by road are founded on the rights of the Post Office Department and so far have made it possible to avoid having transport parallel to the railway lines. In *Austria,* the OeBB have only to give notice of services and can operate, without any other formality, occasional passenger or freight services.

Finally, in countries where rail and road transport is nationalised and their relations regulated by the authorities, the problem of competition no longer arises. In *Czechoslovakia,* for example, the State Railways operate all the railway services, all road services being worked by nationalised undertakings, on the basis of rates ratified and duly published. The railway and the road undertakings do not have to compete against each other to get freight or passengers. Consequently, there is no question of the railway, a national undertaking, taking part in road transport which is also nationalised.

In other countries, where there is a liberal economy as regards transport, it is logical to deduce the right of the railway to carry out road transport, though such a right is limited and restricted in most countries to sharing in road transport undertakings. This is often the case, at least in theory (RENFE, OeBB, Portuguese Railways, CFF, etc.). In *Belgium,* the Minister of Communications expressly stipulated in clause 16 of the law of the 30th December 1936, regulating the transport of fare-paying passengers in motor vehicles, that the SNCB is authorised to acquire an interest in passenger road transport undertakings.

In other cases, the railway finds itself bound here again by regulations and restrictions due to legislation or statutes.

For example in *Germany,* the DB must receive the authorisation of the Federal

(*) « En régie » has been translated in this report by « under separate statutory organization ».

Ministry of Transport to set up or purchase road undertakings or share in such undertakings, when the capital involved exceeds a million DM (Law of the 13th December 1951). In *France,* the freedom to share in road undertakings is also limited either by obligations imposed in the laws and decrees concerning the coordination of transport, or by the need to get government approbation for setting up any sort of road service. The West African Railways also require the approbation of the Governor General. In *Italy,* the direct participation of the FS in road transport undertakings is governed by standards which regulate the participation of the State in private undertakings, standards which make provision for the approbation of the Treasury in every case. In *Belgium,* the SNCV cannot put up any capital for a private undertaking operating road transport services, such an act being incompatible with its statutes. It can therefore only operate such services under a separate statutory organization; it can also rent out the operation of the service to a private firm which thus becomes its tenant. In this way, it keeps control of the route, timetables and rates. In *Switzerland,* the CFF in theory are able to participate without restriction in road undertakings; but they are bound by the contract they have concluded in the case of long distance goods transport with the Fiduciary Association of the Motor Transport Industry (TAG) and the Long Distance Transport Society (GU) not to participate in any fashion in setting up road transport undertakings or competitive undertakings which are not under contract, without the assent of the Central Office, which is the organisation responsible for seeing that this agreement is honoured. On the other hand, so far they are allowed to have a share in passenger transport undertakings.

2. *If you have not taken advantage of the possibility of participating, what is the reason?*

Amongst the large administrations, several have already made use of the right which they are in principle recognised to have to share in road transport undertakings. Most of them state that they do so but give no reasons (Italy, Portugal), or explain that they have been led to do so by the situation that has arisen as a result of the competition of road undertakings (DB). This same reason appears to have influenced the others in their decision.

Amongst those who, whilst being allowed to share in road transport undertakings, have not done so, the greater number, especially some of the overseas railways, state that they have not yet experienced any need to do so, other that their financial position makes it impossible for them to do so (SNCL) or that such participation would only increase road competition (OeBB), or finally that they do not deny the possibility that they will do so in the future, if the situation caused by road competition does not improve. There appears to be a contradiction between the last two explanations. We must admit we cannot understand that of the Austrian Railways, since the participation of the railway has as its whole object to allow the railway to control certain road transport undertakings without increasing *ipso facto* the number of road vehicles and consequently road competition.

Certain administrations, although financially able to participate in road transport undertakings, state they prefer to operate such undertakings under separate statutory organization or to rent them out, which is a form of participation. This is the case with the SNCB. The freight services which they are allowed to operate are worked :

— either by hauliers chosen by adjudication;

— or by a separate statutory organization;

— or by renting the necessary vehicles by the hour.

The latter method has in their opinion the following advantages :

— the SNCB is only bound by a three months contract and no capital has to be expended;

— this system is very simple from the operating point of view since the SNCB is free to use the lorries it rents in any district and in the best interests of the service, just like lorries belonging to it and operated under a separate statutory organization;

— from the commercial point of view, the SNCB remains in touch with its clients; it deals directly with them.

In the case of passenger traffic, the public bus services conceded to the SNCB are worked on the renting out system.

The working of special public bus services to complete the railway services is rented out on payment of a sum representing a certain percentage of the receipts collected.

The working of substitute public bus services is generally assured in vehicles rented at so much the vehicle-km from private firms, the drivers being in the employment of the firm hiring out the vehicles. The fares are collected by SNCB employees.

The operating of special bus services for workmen is conceded to private firms. The SNCB charges a rental fixed at 0.20 fr. per vehicle-km loaded.

The above systems make it possible to keep a close check on certain bus services which compete against the railway and to reduce such competition to a very large extent.

In order to achieve more economical working and become autonomous as compared with private firms, the SNCB is also making a trial of operating two replacement bus services under separate statutory organization (en régie). This experiment is too recent for any well-founded conclusions to be put forward.

In *Switzerland,* although they are able to share in passenger road transport undertakings, the CFF have not done so to date, although they have had the opportunity to do so.

3. *If you cannot participate do you think it desirable to obtain authority to do so, and why?*

Since most administrations are able, though often to a limited extent, to take part in road transport undertakings, they did not reply to this question, as they could see no object in it, either because they already make use of the faculty given them, or, in the contrary case, because, owing to competition conditions, the need for such participation has not yet become a matter of concern (certain overseas countries for example). There does not appear to be any formal interdiction. They are prevented in certain cases by statutory clauses (SNCV). In this case the Administration has other ways of interesting itself in road transport (renting out, hiring), which is also a form of participation.

4. *If you are not able to participate in road transport undertakings and if you do not consider participation desirable, what are your reasons for this view?*

One administration only, which has not the faculty of participating in the capital of undertakings carrying out road services, considers the system it makes use of satisfactory. In fact, the SNCV has been led to act according to the rights it enjoys by the laws and regulations which govern it. In the case of road services replacing or completing a railway line, the SNCV operates the road service in question under a separate statutory orgazination, so as to be able to continue to employ the men formerly attached to the railway. It is only in very special cases that a substitute service is rented out to a private firm.

In the case of a line quite distinct from the railway service, the Company, when a licence is sought from the competent public

authorities, claims the licence itself in the case of a line for which a right of priority has been given it by law. In virtue of its statutes, it is then obliged to find the capital to set up this service, capital intended to cover the first administrative costs. The Company then hands over the actual operation of the service to the first firm asking for it, which becomes the renter.

5. *Are road transport services operated by a separate statutory organization and to what extent? Are there in your country nationalised undertakings other than railways which are operating road transport services with the status of a separate statutory organization? What are the advantages and disadvantages of this system?*

Most Administrations operate road transport services with the status of a separate statutory organization, though to very different extent, and usually on a rather small scale.

The SNCF operates certain transport « en régie », through its subsidiary company the SCETA (Société de Contrôle et d'Exploitation de Transports Auxiliaires). The SNCF has handed over to this latter Company all questions concerning the operating or control of passenger or freight road services carried out in liaison with the railway. This Company has been set up as a limited Company with an actual capital of 475 563 000 Francs. The SNCF holds 83 % of the shares; 8 of the 12 members of the Council are representatives of the SNCF. The rest of the shares are held by secondary railways (2 members of the Council) and Road Transport firms (2 Administrators). Consequently when it is question in the present report of the « participation » of the SNCF in road undertakings, it must be understood that such participation is in reality carried out through the SCETA. In the case of operating under a separate statutory organization (en régie), it is question of services run directly by the SCETA.

The DB also works services « en régie », with its own vehicles and with rented vehicles. The same applies, as we have already seen, to the SNCB. The latter in the case of freight confines itself to terminal transport (door to door services, services to secondary stations from the centre-stations, etc.). In the case of passenger traffic, only two substitute bus services are worked under separate statutory organization, as a trial. The Austrian Federal Railways run under separate statutory organization the services parallel to the railway, the cartage services in Vienna, and in the main provincial cities, as well as wagon-conveying trailer services (Culemeyer system). The Portuguese Railways operate under separate statutory organization a single service 137 km (85 miles) long for passengers. The SNCL has replaced certain steam train and railcar passenger services on narrow gauge lines showing a deficit by bus services operated under separate statutory organization. Considerable savings have been obtained thereby, together with more flexibility for adaptation to the traffic and greater comfort for the passengers (compared with the railway stock previously used).

The FS do not operate any road services under separate statutory organization. A number of vehicles were given to them at the end of the war by the allied military authorities for carrying out different transport services (passenger and freight), to enable them in particular to work relief services (interruptions to the train working, strikes, etc.). The railway transport position has gradually returned to normal, and since the financial results were very unfavourable, the road transport services are now being liquidated.

If the SNCF prefers to call upon private firms rather than operate road services under separate statutory organization, as the former method appears to be more flexible, the DB on the contrary considers that operating such services under separate statutory organization is the most advantageous system. The SNCB which operates

9 haulage services under separate statutory organization out of the 65 working the door to door collection and delivery services, is of the opinion that operating in this way enables to use the vehicles as required and to maintain closer contact with its customers; on the other hand, it has to spend considerable capital on purchasing and maintaining the vehicles. This opinion is also shared by the Portuguese Railways. The Austrian Federal Railways operate passenger services either by means of their own vehicles, or with rented vehicles. Haulage (no long distance traffic) is done both with their own lorries and by private undertakings. On the other hand, the replacement road services are only worked by means of vehicles belonging to the railway.

In Greece, the railways operate under separate statutory organization the services conceded to them. In Portugal, the railways work in the same way a passenger service (137 km = 85 miles), 7 other services being rented out (684 km = 425 miles).

In several countries, Germany, Austria and Switzerland for example, there are other nationalised undertakings operating road services under separate statutory organization. This is the Post Office Department. However, passenger transport is mainly concerned. In Austria, the Mails carry out transport not only in regions where there are no railway services, but also services parallel to the railway, for which the OeBB unfortunately was not able to obtain a concession, as well as occasional services. Such a situation inevitably leads to certain drawbacks. In Switzerland, the PTT Administration, by virtue of the law on the mails, acts as the conceding authority for granting concessions to operate regular passenger road services. Itself it operates a large number of lines (2 500 km = 1 553 miles or so), which most often are complementary to the railway or seasonal tourist services, and has a stock of 373 vehicles. The relations between the PTT and CFF, which do not run any actual motor services are excellent. Perfect collaboration has been achieved, for example in organising group journeys for societies, with excellent results. The Swiss PTT Administration so far has made it its policy in granting concessions to avoid setting up services running parallel to the railway. The two administrations operate in common the Swiss Europabus services.

* * *

II. EFFECTIVE PARTICIPATION.

A. General.

6. *If you are in a position to participate in road transport undertakings and if you take advantage of this, what are your motives for doing so?*

The Administrations, who replied to this question (SNCF, DB, FS), are very positive on the motives which led them to participate in road transport undertakings. The objects in view are multiple. In particular to give a healthy tone to competition and to rationalise the railway undertaking by making use of the two techniques, rail and road.

The first object can be achieved by allowing the railway to control the existing market by its participation whilst leaving certain autonomous road transport undertakings in existence, competition giving place to a clearly understood organic collaboration. In this case, the participation of the railway will tend to prevent its competitor working the traffic for his own exclusive profit. This object can also be attained by allowing the railway to have a better chance of defending its place in the transport market against the competition of other road undertakings. According to the SNCF, in this case it is possible to limit competition to long distance services, both passenger and freight. Finally, participation will enable the railway to make sure of new outlets in the transport field. The most typical example is the use of wagon conveying trailers, according to the SNCF.

The second object is to rationalise the railway undertaking by making use of the two techniques. This is the basis of the door to door collection and delivery services. This organisation has even been completed in the Parisian area by road transport of freight in transit from one terminal station to another, or to a suburban station and vice-versa.

Finally participation will facilitate in many cases the replacement of the railway services on lines with a very low output. This is, in the opinion of the FS, the chief motive leading them to extend as far as possible their participation in road transport undertakings.

7. *To what extent do the undertakings in which you participate achieve these aims?*

According to the same administrations, the results obtained to date have not fully achieved the ends in view. The sole reason for this is the insufficient extent of such participation to date. But the partial results obtained appear to indicate that the method followed is effective and should be extended.

In the case of passenger services, the SNCF considers that an interesting attempt has been made with the Europabus services where participation either directly or by contract has prevented the handing over of long distance tourist services to competitive undertakings. On the other hand, thanks to the policy of making agreements with local road firms, carrying out regular utilitarian and touristic services, the railway has gained a more favourable position for opposing the setting up of long distance services. The FS consider that the special objects of participation have very often been achieved.

In the case of goods traffic, the participation of the SNCF in road transport has enabled it to defend its position, chiefly by making railway transport just as convenient as road transport thanks to the door to door collection and delivery services.

In a general way, the DB is of the opinion that the system of participation has not yet enabled it to put competition on a healthy basis, as the number of road vehicles in opposition to those of the railway is much too high and legislation does not give the railway adequate protection.

8. *What kinds of transport service are provided by the undertakings in which you participate in passenger traffic and goods traffic?*

Since this question was asked of those administrations participating in road transport undertakings, the replies received were few in number.

In the case of *passenger traffic,* the SNCF states that it carries out all the regular categories of traffic: — services which do not run parallel to the railway, feeder services (utilitarian and tourist services); — runs parallel to the railway replacing certain isolated trains (utilitarian services) or supplementing them (luxury tourist services); — runs parallel to the railway taking the place of all passenger traffic, only the freight services being still operated by rail; — replacement services for a railway line that has been given up or closed to all traffic.

It is the same with the DB: non-parallel services, this kind of transport being reserved to a large extent however to the Post office and private firms; — parallel services, replacing or substituting poorly used trains, or lines closed down to passenger traffic, as well as cross-country services making it possible to reduce journey times and rationalize the working. The DB also considers that it is for the railway above all to make itself responsible for long distance passenger road services, in so far as these are wanted by the public and meet tourist requirements. In this order of ideas, mention must be made of the Europabus services, the operation of which has been confided to an affiliated company in which the DB has an interest. The latter also runs occasional services, as far

as they are authorised to do so. But the law on the transport of passengers by road does not allow the DB to reserve vehicles solely for this purpose; they are simply allowed to use some of the motor vehicles used for regular services for transport on demand. In Italy, the passenger road services in which the FS participate are generally run over routes parallel to the railway, replacing trains that have been suppressed or which would have had to be run to cope with the increased traffic. In addition, services are run over routes having a special tourist interest, although not parallel with railway itineraries. Such traffic is worked by the CIAT with its own vehicles and organisation, this being a special undertaking in which the FS participates indirectly.

The SNCB chiefly runs substitute and complementary bus services, as well as long distance tourist services (Europabus).

In the case of *freight traffic,* the following transports are run in participation :

a) small parcels services (collection and delivery) are operated by the SNCF in all places where there is sufficient traffic to justify it. The service is even obligatory in towns of more than 5 000 inhabitants less than 5 km (3 miles) from the railway station. The DB only participates in parcels haulage services to a very small extent, such services being in principle left to the consigning firms. Regular services of this type are however carried out by the DB on routes at some distance from the railway;

b) the haulage of full loads is carried out by the SNCF in certain places. As also by the DB and their transporters;

c) the use of special types of containers, by the DB, but not by the SNCF. The latter on the other hand participates in container services in the case of containers carried on the usual types of wagons;

d and *e*) participation in the operating of rail-road trailers and wagon-conveying trailers on the SNCF but not on the DB;

f) the DB is also interested in special transport by means of wagon-conveying trailers, not only on routes served by the railway but in all cases;

g) neither the SNCF nor the DB are interested in furniture removal services which are left to private firms;

h) services (parcels traffic) replacing railway lines closed to all or some freight traffic are carried out in participation by the SNCF and the DB. The latter also makes use of them to save wagons or speed up the transport. In Germany, so far no railway line has been completely closed to freight traffic;

i) both the SNCF and the DB are interested in long distance road traffic. In France, this carried out more particularly to complement the railway on cross country routes.

The FS also participate in haulage services (collection and delivery), wagon-conveying trailers, certain furniture removal services, as well as substitute services, especially on lines whose working was interrupted by the war.

For each of the categories of traffic mentioned above the mileage of the services operated was asked for. Only one Administration was able to give these figures, so they have no comparative value, and we will not give them here.

9. *Have you participated in road transport undertakings already in existence or have you established new undertakings for the purpose? Have you a preference for one or the other of these methods. If so, why?*

In France, the railway generally speaking has participated in transport undertakings that were already in existence. But it has also set up or participated in the setting up of new undertakings in the following cases :

a) control of existing road undertakings in which it participates and operation of check services to enable them to carry out better control. It was with this object that the SNCF set up its affiliated company the SCETA mentioned under question 5;

b) operating with new techniques or to replacing faulty techniques, for example operating with containers (Compagnie Nouvelle des Cadres), operating rail-road trailers, haulage services in certain towns.

The railway has also encouraged the setting up of new firms in which its affiliated company the SCETA participates.

In Germany, the DB has participated since 1949 in the TOURING Company, which operates in particular the Europabus services. It has also bought up several private undertakings which have been included in its operation. One of these has however remained in operation as an autonomous undertaking, but it is not yet possible to state to which system preference should be given.

In Italy, new undertakings have been founded (INT, CIAT) and the FS are the chief shareholders. In the case of other existing undertakings different forms of participation have been adopted.

10. *Does the railway co-operate with the road transport undertakings in which it participates in actually dealing with the traffic and if so in what spheres (timetables, rates and fares, conditions of carriage)?*

Although the replies received were very few and very brief, it is possible to deduce from them the interesting fact that the formula of participation opens up a wide field of possibilities of collaboration.

In France, the railway collaborates in carrying out *passenger transport* by getting out timetables connecting with the trains and in the form of various contributions as follows :

— special rates for combined road-rail journeys (tourist tickets, combined railway-road tickets);

— publicity;

and, on payment of certain dues :

— supplying tickets, small flags;

— checking the services;

— giving guarantees to enable loans to be obtained for the purchase of stock.

In Germany, the DB gets out the timetables, and decides the rates and conditions of transport (collaboration with TOURING). In other cases, they operate certain services in common, either on the basis of common licences, or, if the licences have been granted separately, on the basis of agreements laying down the rights and obligations of each partner. There is similar collaboration in certain cases with the Postal Authorities, with tramway companies, and even with private firms.

The FS also collaborate in every way (timetables, rates, conditions of transport) with the carrying out of the service. It is the same in Belgium (SNCB and SNCV) in the case of the rented out services, and in Portugal and Spain.

In the case of *freight services,* the SNCF collaborates in the carrying out of certain transport by directing the working entirely, except as regards the question of stock. This is the case with the charter services replacing the railway in the case of lines closed completely or partially to freight traffic.

In the case of other transport, collaboration consists in certain rating concessions linked up with given operating conditions (rail-road trailers, wagon-conveying trailers).

Finally as regards the haulage of parcels and full loads, the railway decides what the undertakings shall be paid, taking all the operating conditions into account.

11. *Economic and statistical information to be given as under for each category of service set out in Question 8 :*

The replies given to this question were very few and had no comparative value. Generally speaking, it is only possible to give precise details about services operated directly. On the other hand, as regards other services, the SNCF justly reports that it is impossible to supply details except in a very fragmentary way. In fact, the contracts between the SNCF and these services are of very different sorts. They

may give a certain measure of control of the working enabling certain statistics to be prepared (charter services) or it may be merely a question of supervision in which case it is not possible to give figures for the traffic factors (feeder services).

In the case of *passenger services,* the SNCF indicates that in the case of services operated directly, 94 vehicles and about 2 000 services in participation (charter, feeder, tourist) for which they cannot give the number of vehicles. The DB mentions 1 255 cars, 880 of which are owned by it, and 375 by contractors; the FS 137 cars. The approximate number of passengers carried by all these services (operated under separate statutory organization or by participation) and passenger-kilometres is estimated respectively by the SNCF as 8 and 255 millions, by the DB as 105 and 1 520 millions, and by the FS as 4.5 and 120 millions.

In the case of *freight services,* in *France* the long distance charter services have always remained in the trial stage so organised that the SNCF had a precise knowledge of the long distance lorry traffic; the number of lorries has never exceeded 20 (39 agents, 18 lorries for a useful tonnage of 232 tons, 44 262 tons carried in 1952, with 12 million tonnes-kilometres).

In the case of the wagon-conveying trailers, the number of vehicles is 39, with 250 000 tons carried annually.

The haulage and parcels re-consignments services and full load services being run by private firms, there are no statistics available about the number and capacity of the vehicles. The vans used for the parcels traffic and postal packages are usually of 2 tons and the lorries for the mixed consignments of 3.5 tons.

The number of services is given in the table hereafter.

Altogether 80 % of the French people enjoy a service organised by the SNCF or other similar service. These services account for 85 % of the parcels traffic or small consignments (25 million parcels, or nearly 400 000 tons), 60 % of the small consignments' traffic (15 million consignments or more than 2 million tons) or altogether: 65 % of the traffic consigned with a weight of 2 500 000 tons.

	NUMBER	
	of services	of places served
Services organised by the S.N.C.F. (haulage, reconsignment) . . .	3 450	10 000
Secondary systems operated by road according to a change-over agreement . . .	60	1 500
Services assured by the Postal Authorities directly by its postal services or by the rural post office vans . . .		7 000

The most important haulage services are obviously those organised in Paris and its suburbs, which in addition to the transit traffic between the various Parisian stations, are responsible for the door to door services in Paris and nearly 200 municipalities of the Paris area (1).

The DB reports 2 720 lorries, 1 750 of which it owns itself and 970 of which belong to contractors; the FS 283 lorries. The number of tons carried and the tonnes-kilometres is estimated by the DB as 3.06 and 504 millions, by the FS as 1.7 and 9.3 millions. The larger part of the traffic

(1) The suburbs of Paris are divided up into a certain number of areas each attached to a selected station known as the « gare ilot ». Parcels are transported directly from the terminus stations of Paris to these stations and vice versa by lorries and trailers, after which they are delivered to the consignees by the actual haulage services.

Haulage services in Paris and Suburbs of Paris.

Total number of persons employed:			1 500
Number and tonnage of the vehicles used:			
1) *SCETA stock :*			
Tractors	5 t :	87.....	435 t
	8 t :	125.....	1 000 t
Various lorries :		44.....	125 t
Trailers :	5 t :	301.....	1 505 t
	6 t :	8.....	48 t
	8 t :	309.....	2 472 t
2) *Stock of hire firms Paris :*			
Tractors :	5 t :	29.....	145 t
	8 t :	158.....	1 264 t
Various lorries :		80.....	240 t
Trailers :	5 t :	60.....	300 t
	8 t :	388.....	3 104 t
General total :		1 589.....	10 638 t
Suburban haulage services :			
Number of vehicles (hire firms)			205
Useful tonnage of the vehicles			706 t
Useful tonnage carried (1952)..			138 500 t
Kilometric tonnage (1952)			1 660 000 t

of the latter administration is covered by the wagon-conveying trailers and the road transport of certain suitable goods over routes parallel to the railway.

The RENFE operates 44 passenger services with 186 buses; 43 lorries of 3 to 5 ton capacity are used for the RENFE traffic and haulage services in Madrid.

The motor services of the Austrian Federal Railways, who employ a staff of 1 860, cover 129 regular services of a total length of about 6 800 km (4 225 miles). For freight traffic, the stock consists of 264 buses, 165 lorries and tractors and a certain number of vehicles for internal services.

12. *In the case of the road transport undertakings in which the railways participate, what is the size of the road traffic carried, expressed as a percentage of the traffic carried by rail and also, if possible, of the total road traffic carried by the professional road carriers in your country?*

In France, the long distance charter traffic represents about 1/4000th of the total kilometric tonnage of the SNCF and the receipts 1/2500th of the total goods receipts of the SNCF.

The tonnage carried by the wagon-conveying trailers amounts to about 0.14 % of the total tonnage carried by the SNCF and the Paris and suburbs haulage services carry 0.433 % of the total tonnage.

It is not possible to supply statistics of the percentage of professional road traffic.

The DB gives more precise information.

Traffic	*Paris*	*Suburbs*	*Total*
Door to door services (collection and delivery) parcels — small consignments . .	2 400 000 parcels	1 300 000 parcels	3 700 000 parcels
Parcels traffic	178 000 tons	114 000 tons	292 000 tons
City offices (collection) parcels — small consignments	8 128 000 parcels	...	...
Parcels traffic	192 000 tons	...	...

In the case of passenger traffic, the number of passengers carried represents 8.5 % of the total traffic of the railway, that of the passenger-km 5.2 %; in the case of freight traffic, the number of tons transported (263.5 million) represents 1.2 % of the total traffic of the DB, and of the tonnes-kilometres : 1 %. Out of the 435 000 employees of the DB, about 10 000 are concerned with the operation of the road services. The DB's share of professional road traffic (including the Post Office services) in the case of passenger traffic represents 14 % of the bus services, 6 % of the vehicles, 7 % of the passengers carried and 9 % of the vehicle-kilometres. It is not possible to give comparative details for the freight traffic.

In the case of the FS, the number of passengers carried by the road services in which it participates represents 1.26 % of the railway traffic, that of the passenger-kilometres 0.56 %, number of employees 0.38 %, and length of services operated 39 %. In the case of freight traffic, the proportions are 0.18 % for the number of tons carried, 0.038 % for the number of tonnes-kilometres. The FS are not able to give any figures for professional road traffic as a whole.

In Portugal, the number of passengers carried by the road services in which the railways share, represents 1 % of the railway traffic and 1.4 % of the road traffic, the number of passenger-km being respectively 0.1 % and 0.2 % of the railway traffic. In the case of freight traffic, the proportions in comparison with railway traffic are 2.4 % for the number of tons carried, 1.4 % for the staff and 2.8 % for the length of lines operated (3.5 % of the road system).

B. Methods of participating.

13. *In what way do you participate in road transport undertakings?*

Participation in road transport undertakings takes place both :

a) by contract assuring certain prestations to the railway (France, Germany, Italy, Belgium, Spain, Austria and Portugal);

b) by direct participation in the management (France, Germany, Italy, Portugal and Spain).

14. *In the case of participation by contract what forms does this actually take?*

a) *A contract under which the undertaking accepts an obligation to provide certain services for which payment is made?*

b) *A partnership agreement under which the railway receives a proportion of the receipts and shares in the risks of the service?*

c) *Other conditions of contract affording advantages to the railway.*

a) In France, passenger transport services are never rented out. On the other hand, in the case of freight, the contracts made with the firms carrying out the terminal haulage operations for the railway (haulage, re-consigning) can be compared to renting out contracts. These firms carry out the transport and are paid so much per traffic unit (according to the number of parcels and the tonnage) according to a scale based on local operating conditions.

Renting out is also practiced by the FS, SNCB, SNCF, RENFE and Portuguese Railways.

b) In France, a partnership contract is occasionally made in the case of motorbus services the concession of which has been given to the SCETA alone or to the SCETA in conjunction with some other road undertaking.

In Germany, the contract concluded between the DB and the TOURING regulates the reciprocal duties of the two partners.

This system is also used on the FS.

c) In France, all existing contracts can be grouped into the following categories :

Passenger traffic :

Charter contracts : These services are operated by road firms who are paid a fix-

ed sum. The railway collects the receipts and remains in control of the timetables and rates.

Tourist service contracts : The transport firms remain in control of the working but are subject to certain obligations as regards the stock, the timetables and non-competition with the railway. They pay an annual fee to the SNCF. The latter in return advertise these services in its leaflets.

Contracts for feeder services : Such contracts are made with the regular utilitarian services. They only bind the road undertakings to observe certain timetables. They may, but not necessarily, include an annual payment to the SNCF.

In Germany, the DB contracts also cover charter services (for which the undertakings are paid), the joint working of bus services, participation in the profits of undertakings operating certain regular lines.

In the case of freight traffic, the chief system used in France is *chartering* : charter contracts are made for long distance traffic and for replacement services for certain railway lines closed to traffic (centre-station organisation). Payment is made either at so much the kilometre (long distance) or so much per traffic unit.

In Spain, certain lines of the RENFE are operated on the basis of an agreement with transport firms.

15. *In the case of direct participation in the management of the road transport undertaking, what form does this take ?*

We have already reported under Question 5 the special position of the SCETA, the affiliated company of the SNCF, which deals with all road transport questions on behalf of the latter. The SNCF participates directly in the management of the SCETA.

The DB also, in the case of the TOURING has the right to nominate the members of the administrative council and supervisory council. The FS have the same rights over the transport undertakings in which they participate.

16. *In the case of participation in the management by what method is this effected ?*

As the representative of the SNCF, the SCETA participates in the management of a certain number of road transport undertakings. The ways in which it does so vary, and include : the holding of shares, the granting of credits, the hiring of stock; all or some of these factors can apply.

As regards the granting of credit, this is not granted directly by the SCETA, which acts as guarantor in order to obtain loans from the National State Funds.

In the case of passenger transport, the only form of participation is the granting of credits to enable stock to be bought.

In the case of freight traffic, participation is on a larger scale and more varied, and includes all the above mentioned factors.

It is difficult to estimate the relative importance of each of these factors, conditions varying with each undertaking in which the SCETA participates.

It may be noted that the credits allocated for buying stock for which the SCETA has acted as guarantor is of the order of 2.5 thousand million francs.

In Germany, the participation of the DB is based essentially on the holding of shares and social bonds.

In Italy, the FS participates directly in road transport undertakings by taking up the majority of the shares. In certain cases, participation takes place through the intermediary of other organisations controlled by the FS, who hold the majority of all the shares. In the case of the INT, the FS is the only shareholder. As for the CIAT, the FS participates in its share-capital through the CIT and INT, both of which are controlled by the FS and hold equal proportions (33 % each) of the majority of the capital of the CIAT. The other capital

shares belong to private firms (motor firms, banks, industrial firms).

The Portuguese Railways also have rights due to holding shares in the undertaking.

17. *In the case of participation in the capital of the undertaking :*

a) *Does the investment represent a majority, equal or minority holding?*

b) *If there are other shares are these held by private individuals, private undertakings, the government or government undertakings ? If so, in what proportion?*

In *France,* the participation of the SCETA in road transport is also a minority. The object in view has not been to absorb the road undertakings but to set up groups of undertakings whose interests may perhaps be divergent, in which case the SCETA acts as arbitrator. This method makes it possible to maintain good relations with undertakings having a tendency to compete against the railway. It is often possible to limit their competition to an acceptable level.

In *Germany,* the participation of the DB is generally slightly in the majority. It is also a majority in *Portugal.*

In *France,* the other shareholders are always private persons or private firms belonging to the transport profession. The Government or government undertakings are never shareholders.

In *Germany,* in the contrary, the other shareholders are chiefly organisations close to the DB, such as the DER (Deutsches Reisebüro Gmbh) or European Luggage Assurance Co. (Europäische Reisegepäckversicherung). There is only a small group of private shareholders. The Government or other Government undertakings are not shareholders.

In Portugal, the other shareholders are private persons.

From the replies received it appears that in the case of passenger traffic, there is rarely any participation in road undertakings, in the case of transport which is not parallel to the railway, preference so far being given to direct operation or operation by contract. The essential consequence of this situation is that the administrations have practically no concern with occasional road services (except in rare cases). On the other hand, participation (by holding the majority or minority of shares) is more frequently made use of for the different kinds of freight traffic.

18. *Is your right to participate in the management favoured by :*

a) *The status of the railway undertaking (private enterprise, nationalised or a mixed system) ?*

b) *The policy in regard to co-ordination adopted by the government authorities ?*

In France, it is considered that the nationalised character of the railway undertaking is a certain hindrance to the right of participating in private enterprise, as any participation scheme must be submitted to the financial control organisation of the SNCF. In Germany, the DB on the other hand considers that the character of the railway undertaking has no influence at all on its right to participate.

In Italy, owing to their nationalised character, the FS come under various obligations and controls.

In general, it is found that the coordination policy of the government authorities has not affected the right to participate in the management of road undertakings already entitled to carry out transport. The situation would be rather more delicate in the case of new undertakings (France). This same policy has not proved any hindrance in Germany. In Portugal, the private enterprise character of the railway favours the system of participation.

In Italy, however, neither the character of nationalised undertaking of the FS nor the coordination policy followed by the Government authorities favour the participation of the FS in private transport undertakings.

C. Organisation.

19. — *Is there any special organisation responsible for securing co-ordination between the railway and the road transport undertakings in which you participate? If so, what is this organisation and what are its functions?*

In France, the SCETA centralises all the activities of the SNCF in connection with road transport; this company therefore plays the part of a coordinating organisation. The other Administrations consulted did not report any similar organisation in connection with the railway.

Several Administrations can make use of a central coordination service (Spain, Germany) or a motor service (Austria).

The responsibility for coordination is usually placed on a government department attached to the Ministry of Communications. In Italy, the ministerial commission for motor services set up in the Ministry of Transport and presided over by the Under Secretary of State, on which representatives of the FS and Motorisation Inspectorate sit (as well as representatives of the economic groups concerned) is responsible for giving a decision on demands for creating new motor services and modifications or alterations to existing services.

Another commission, also attached to the Ministry of Transport on which representatives of the FS and Inspectorate of Civil Motoring sit, is responsible for examining the modalities according to which the FS should act in the case of replacement road services authorised by the Ministry of Transport, which they intend to operate in collaboration with private undertakings, taking into account existing road services in the same area, the firms operating these and the effects of the new service on the existing services. This commission is charged in particular with nominating the undertakings which shall operate the replacement services, if a competition has to be organised or on the contrary direct discussions arranged, etc.

Similar institutions (government commissions on which railway representatives sit) exist in several countries.

20. *Have the different road transport undertakings in which you participate a common organisation independent of the railway responsible for the co-ordination and rationalisation of their activities? How does this organisation work and what is the field of its activities?*

No such organisation functions in any of the countries consulted.

21. *Are the road transport undertakings in which you already participate regarded as large, average or small concerns? To which type of undertaking would you give preference if the choice still had to be made?*

In *France,* the railway participates in large, average sized and small undertakings. The small and average sized undertakings in certain cases make it possible to obtain better financial results than the large, but relations are easier with the latter, and the agreements and contracts whose effects are obviously increased by the size of the undertakings are more closely followed. It is also possible with large undertakings to get out a long term policy, so that if a choice had to be made it would be better to give the preference to large undertakings.

In *Germany* and *Portugal,* the firms can be considered as large undertakings. In *Italy,* the undertakings in which the FS participate are of all sizes; no preference can be expressed for any given size of undertaking (large, average or small), seeing that this question ultimately depends on the nature of the service. In *Belgium,* the possible output of certain bus lines are so small that according to the SNCB they can only be reasonably run as a small or family business. The undertakings used can be considered as small and average sized. The choice of the kind of undertaking appears moreover to be conditioned by the importance of the services to be assured.

III. RESULTS OF PARTICIPATING.

A. Financial.

22. *What is the amount of your investments in the road transport undertakings in which you participate?*

23. *What is the relationship of these investments to the total investments of the railway undertaking?*

24. *What was the amount of the annual operating receipts and expenditure of the road transport undertakings for each year from 1948 to 1951 inclusive?*

25. *What was the amount of the annual operating receipts and expenditure for the railway for each year from 1948 to 1951 inclusive?*

What was the state of the profit and loss account for each of the same years?

26. *What is the total amount of the dividends received from the road transport undertakings or of the subsidies granted to them?*

The question of the capital invested in road transport undertakings depends above all on the internal affairs of the administration. It must however be admitted that they are very small compared with the total investments of the railway undertakings. They are even, it must be recognised, insufficient when the objects to be attained are considered (Question 6).

As regards the total annual receipts and costs of operating road transport undertakings, it is not possible to give any useful data, still less any comparable data, either because the administrations concerned do not keep general accounts of their participation in road transport undertakings, or because the way in which an administration participates varies from one case to another, and also because of the very nature of the road undertakings in question. For example in *Italy*, several of the undertakings in which the FS participate have not exclusively the character of a motor transport undertaking, since they also concern themselves (like the INT) with a great many other activities. Other undertakings, especially the smaller ones, in which the FS do not participate but to which they have confided certain replacement services under different forms of contract, not only work such services for the FS but also run certain services completely independently of the railway.

Consequently, owing to lack of a sufficient basis, it is impossible to state the part and proportion of annual receipts and costs of the railway road services in the total financial balance sheet of the latter.

27. *Does participation in road transport undertakings result in a worsening or an improvement of the financial results of the railway and to what extent?*

It is very difficult, owing to lack of sufficient information, to say if participation in road transport undertakings results in the financial results of the railway being increased or improved. It is moreover difficult to give a general reply owing to the different forms of participation and kinds of services to which this applies. It appears that the latter is the determining factor. The working of a regular service, whether as a replacement or complementary service, often shows a deficit, owing to the obligations with which it is burdened, if the undertaking responsible for it cannot also undertake more profitable activities at the same time. In the case of freight traffic, the information given by the administrations is even scantier. The participation of the railway has as its main object in this case the reduction of its own costs, the carrying out of certain operations by autonomous undertakings in which the railway is interested being more advantageous and rational than for the railway to do them under a separate statutory organization (en régie) (the road firm being less subject to restrictions than the railway).

B. Other results.

28. *What are the results of the participation of the railway in road transport under-*

takings from the national economic point of view :

a) *Has it brought about an improvement in the public transport services by rail and road ?*

b) *Has it facilitated the organisation by the government of co-ordination between the different means of transport ?*

c) *Has it eased relations between the railway and the road transport undertakings ?*

It can be admitted that in general participation has made it possible to improve the quality of the public transport services by rail and road. In *France,* the organisation of haulage services in the Paris area has very appreciably reduced transit times. In *Italy,* the FS consider that certain passenger services are faster, more convenient and more frequent when carried out by the substitute road service than by train. Certain tourist services, entrusted to the CIAT have itineraries and characteristics they could not possibly have by rail. In the case of freight traffic, the organisation of terminal services has been greatly improved (for example in Italy a close collaboration between the FS and INT). In every case, participation has facilitated the coordination of the timetables and tariffs of the railway and road services.

On the other hand, to date their influence on governmental coordination policies has been very little. However, as a certain tradition becomes established in the domain of participation, and provided the railway follows a consistent and constant policy, it can be admitted that there are certain indications that the coordination efforts of the government authorities will be facilitated and influenced, the more so as the participation policy of certain railway undertakings has often had the effect of facilitating and improving relations between the railway and road firms (France, Italy), although it is not always possible to pass a final judgment on this problem (Germany). It often seems that the government authorities will have less hesitation in allowing the railway to carry out road transport services when the latter are worked by autonomous undertakings, even though under their control.

29. — *Has the economic position of the railway been strengthened as a result of its participation in road transport undertakings ?*

In none of the cases considered has the participation of the railway in road transport undertakings enabled it to acquire the lead in the transport market. The ambitions of the railway do not often go so far, and in general this result is not even aimed at. On the other hand, the agreements which have been made, the new facilities offered to clients, have contributed towards protecting railway traffic against road competition. New outlets have been opened up, and the terminal transport of freight has been improved and perfected, which in many cases has enabled the railway to retain its clients.

30. *If participation resulted from the need to rationalise railway operation has it reduced the cost of movement of traffic transferred from the railway to the road services ?*

In general, it is agreed that the system of participation, whilst allowing the railway to have recourse with less hesitation to the technique of road transport, has resulted, especially in the case of substitute services, in real rationalisation, especially when it has made it possible to avoid increasing the railway services on lines operated by steam traction. In this case, the cost of a road service is considerably lower. It is not however possible to give a figure to the savings realised.

31. *What are the economies which have been achieved through the subsequent regrouping of small road transport undertakings following railway participation ?*

No administration has done this. The essential cause must be looked for in the fact that none of the administrations in question has, especially in the case of freight

traffic, sufficiently powerful affiliated companies with a sufficient stock of vehicles for any action in this field to prove effective.

32. *Do you consider that participation has achieved its aim? If not, state for what reasons?*

34. *If on the contrary you feel that participation has not achieved its aim, what are the reasons for this failure and what steps are you considering taking to overcome the difficulties encountered?*

In general, it can be agreed that the participation of the railway in road transport undertakings, where it has been possible to achieve this, has enabled some of the objects in view to be attained.

Several administrations consider, however, that the successes gained cannot be considered complete, nor even sufficient, not on account of the intrinsic difficulties of the railway, but rather owing to the limitations or obstacles placed in the way of the rational extension of the railway's road services. It has not had sufficient liberty to carry its policy out methodically where it has been proved of value.

33. *If you consider that railway participation has achieved its aim, are your contemplating extending such participation still further?*

The administrations appear to be in favour of extending participation once they have gone in for it, especially as regards services replacing railway services on lines with a deficit where the working cannot be improved sufficiently, as well as regards long distance tourist services.

RESUME AND SUMMARIES.

1. In general, it has been found that the laws or statutes regulating the railway administrations allow them to a large extent to operate road services.

2. This possibility, which the railways justly claim, is not however boundless. It is often restricted by the clauses of the laws on coordination or on administrative practice, the setting up of road services often requiring authorisation. In its report of February 1951 on the « situation of the European railways » the International Railway Union regretfully found this was so :

« Finally, we read in this report the railway is generally not able to use in a flexible fashion the two techniques of rail and road transport, according as the cost of working the traffic by one or the other is the more advantageous.

» On the one hand, the specifications or legal prescriptions very often contain restrictive clauses, which do not allow the railway freely to operate motor and lorry services and subordinate this faculty to governmental decisions.

» Frequently also, the railway is not even allowed to charter private road transport undertakings.

» On the other hand, in the present state of legislation, railway undertakings hesitate to abandon part of the traffic to road transport firms, even when it is clear that the latter can work the transport at lower cost. This is because any such act often has serious repercussions on the traffic remaining to the railway which the latter can transport — and does transport — at a lower cost. »

3. Such limitations vary moreover from one country to another. In general, the administrations have fairly extensive rights as regards working road services to replace unprofitable railway services. They can also complete their railway services by road services when the former are insufficient to satisfy traffic requirements, or in the case of freight, for door to door collection and delivery services of the centre-station services.

4. As regards the form such road services take, this varies very much from one Administration to another. In general, the administrations have to date preferred to operate such services, both passenger and

freight, themselves. This, it is true, in the case of passenger services, is done essentially in the case of the replacement services, and in the case of freight, for complementary services, such as haulage, containers, railroad trailers, or wagon-conveying trailers, or replacement services. The administrations have also frequently made use of working by means of contracts with road firms (generally charter contracts or hiring vehicles). In some cases, there is also a partnership contract. On the other hand, actual financial participation, whether to a major or minor degree, involving direct participation in the management of undertakings retaining their administrative autonomy has not occurred to date, except in a few given cases in Germany, France, Italy and Portugal.

5. Another fact which emerges from the enquiry made is that transport carried out by means of the railway's own road services, their affiliated companies, or undertakings with which they have made contracts, either in the case of passenger or freight traffic, represents only a very small proportion of both railway and road traffic. The largest proportion is to be found in Germany. This fact is all the more striking as since the end of the war, road traffic has not ceased to increase at an accelerated pace, the number of motor vehicles has constantly increased, and motor technique has made ceaseless progress, so that this method of transport has become increasingly convenient, effective and economic, and its capacity ever greater. It is therefore rather paradoxical that the railway as a public transport undertaking has not had recourse to a much greater degree to motor technique, as it generally has had the faculty to do.

6. The causes of such a situation are multiple and various, although it is difficult to disengage them from the replies received. It appears that the direct operation of passenger or freight road services has not always been found very profitable. Have experiences in this field led the government authorities to have certain doubts about letting the railways embark thereon? Possibly. The very high social burdens of the railways, and perhaps certain psychological factors, have not perhaps favoured such a development. However, the railway administrations have not gone in to any extent for financial participation, whether to a major or minor degree, or have only done so timidly, apart from certain cases. Financial reasons — the railway having to husband its resources which are often insufficient for railway working as it is — as well as the psychological factor, and it must be said, the absence of any well-defined and homogenous doctrine, have been the causes of this hesitation. This is all the more surprising in that those administrations, which have to date practised the system of participation, have found it satisfactory. They are unanimous in recognising that this method enables the railway to control by this means certain markets, make sure of important positions, and in general, be in a better position to defend its interests against competition, and even obtain new outlets, and above all leads to a rationalisation of its working by the use of both techniques. It also seems, that with certain exceptions, the government authorities look with greater favour on the system of participation than on direct working, which involves the railway in further capital investments without any guarantee of profitable working. It is easy to understand the reasons for this. In the case of passenger traffic, direct operation by the railway of regular passenger services by road is linked up with the obligation to carry which is added to the other burdens falling upon the railway administration. In the case of freight traffic, direct operation of haulage services has not the same flexibility as when they are run by an autonomous affiliated company, whose vehicles can be used in a completely rational fashion. It must also be recognised that the direct operating of road services means putting new vehicles into service which increases the number of road vehi-

cles and increases competition, as the private undertakings will be still keener to get the traffic they need.

7. These considerations mean that the problem of the participation of the railway in road transport undertakings must be solved within the framework of a general transport policy and must satisfy the principles of a well-defined traffic doctrine. The coordination of transport is under study in most European countries with a liberal economy according to which the transport apparatus has developed. Where such studies have led to legislative measures, these have only had partial results and have proved insufficient, when they have not been a complete failure. In no country has coordination yet been achieved by means of legislation. Indeed it never will be, as the interests at stake are too irreconcilable. It will no doubt be recommended that the railway be freed from certain of its burdens, and that those on road traffic be increased, so that it will pay its share of the cost of maintaining and modernising the road system. Such measures, the carrying out of which comes up against innumerable and even insurmountable difficulties, where political interests often come into play, will never solve the problem completely, and are often mere palliatives. Certain administrations during the last few years have done their best to find a solution by means of partnership agreements. Experience is too recent for any valid conclusions to be arrived at. Without wanting to deny the interest of these agreements and their constructive character, it is however not too temerarious to state that they cannot but be imperfect, because they are the crystalisation of a given situation at a given period, whereas in this domain everything is in a perpetually fluid state. Though the railway administration can promise to observe the clauses of such an agreement, how can any professional association guarantee validly that these same clauses will be applied with discipline by all its members, who form an infinity of different undertakings which is difficult to check?

8. It can then be asked if the best solution would not be to admit an organic coordination of land transport, recognising that the railway administration has the right to make full use of the road technique, according to the requirements of rational working and the exigencies of the cost, preferably by means of participation in road transport undertakings, which may consist of taking a major participation or even in buying up road transport firms which will then continue to operate as autonomous undertakings, in participation to a minor degree, giving a sufficiently effective control of the undertaking, or in participation by means of contract (for example partnership contracts).

Participation offers a vast range of possibilities and great flexibility. It assures the railway a much stronger position in the transport market. It also enables it to rationalise its services by using the road technique without hesitation and much more freely. It is indisputable, in fact, that in the case of passenger and freight services, certain traffic can be worked more cheaply by road. The railway should be able to send it by road. It should be able to carry out transport from one end of the journey to the other by road. The method of participation may prove more economical in this respect, more effective and more satisfactory for clients than tariff agreements between associations.

9. Such a conception presupposes a coherent doctrine, both on the part of the government authorities and of the administrations. It is for the former to fix in an unequivocal fashion the principles of such an organic coordination, by authorising the railway in particular to make use of the road technique wherever this is the more effective, encouraging in particular the system of participation, which may go as far as buying up road transport undertakings, and by supporting the railway in the ap-

plication of these principles. The railway administration on its side should follow the same objective in a consistent and logical fashion. One method is to set up a road transport department at the central administration, where this has not been done, whose duty it will be to study the modalities for using the road technique for certain passenger services (substitute or complementary services, tourist services) or freight services (haulage, terminal services, door to door services for certain goods), the possibilities of participation in autonomous road undertakings, and the control of such participation. We consider that such a method, by freeing the railway from the heavy burden involved under present conditions of a unilateral use of the railway technique, avoiding at the same time nationalisation with its serious consequences, ineffective legislative measures or agreements which falsify the costs, will contribute in a decisive fashion towards solving the problem of coordination, the solution of which has so far proved nearly as difficult as squaring the circle.

[385. (06 .111]

OFFICIAL INFORMATION

ISSUED BY THE

PERMANENT COMMISSION

OF THE

International Railway Congress Association.

Meeting of the Permanent Commission, held on the 21st. November, 1953.

The Permanent Commission of the International Railway Congress Association held a meeting on the 21st November 1953 at 3 p.m., in the Belgian National Railways Headquarters Offices, in Brussels.

* * *

Mr. De Vos, President, opening the meeting addressed a warm welcome to the personalities present. He then requested the Assembly to approve the Minutes of the Meeting held on the 17th January 1953.

The President informed the Meeting that Lord Hurcomb, Chairman of the British Transport Commission, and Member of the Executive Committee of the Permanent Commission, and Mr. P. Ghilain, Directeur du Matériel et des Achats, Belgian National Railways, Vice-President of the Executive Committee and General Secretary of the Association, have retired.

He recalled that according to Art. 6 of the Rules and Regulations, a written ballot has been made in order to prorogue the mandates of these personalities until after the London Congress and announced that these proposals have been unanimously welcomed by all the members of the Permanent Commission (*adopted*).

Mr. Ghilain, *Vice-President and General Secretary,* informed the Meeting of the changes, which occurred in the Permanent Commission since its last meeting and of the steps taken to fill the vacant mandates.

The Assembly approved the nomination of the following personalities as members of the Permanent Commission :

Mr. W. H. Maass, Advisory Engineer to the High Commissioner for the Union of South Africa in London, will supersede Mr. G. Lindenberg, who has returned to South Africa.

The two personalities of the Argentine Republic, Messrs. Raphael Luna and P. P. Martin are no more holding any position in the Government and the necessary steps have been taken for the designation by the Argentine Government of other high officials for these two mandates.

Mr. Hussein Abu ZEID, Minister of Communications for Egypt, to replace Mr. Taraf ALY;

Mr. Mohamed Aref ABOUL ATA, Under-Secretary of State to the Ministry of Communications, Egypt, to replace Mr. Abdel Rahman el Sayed AMMAR;

Mr. A. M. RISZK, General Manager of the Railways, Telegraph and Telephone, Egyptian Administration, to replace Dr. Sayed Abdel WAHID, former General Manager;

Mr. Abdel Moneim RASHAD, Deputy General Manager of the Railways, Telegraph and Telephone Egyptian Administration, to replace Mr. Hassan FAHMY;

Mr. PORCHEZ, Deputy General Manager, French National Railways, to replace Mr. LEMAIRE.

Sir V. M. BARRINGTON-WARD and Mr. R. A. RIDDLES, members of the Railway Executive, British Railways, having retired, will be replaced in the near future.

Mr. Ranald J. HARVEY, Consulting Engineer to the Government of New Zealand, in London, has resigned his office and sent in his resignation of member of the Permanent Commission. The designation of his successor has been requested.

Mr. GHILAIN in this case mentioned that Mr. HARVEY was a member of the Permanent Commission, since 1930, and has always devoted the greatest interest to the works of the Association, he said that he was of the opinion that it would be fair if the Permanent Commission would show its gratitude to Mr. HARVEY by using in his favour the means which will be at its disposal by the alteration of the Rules and Regulations after the London Congress, and nominate Mr. HARVEY, Member of Honour.

This proposal was adopted.

A similar proposal made by Mr. T. C. COURTNEY, Chairman of the Coras Iompair Eireann, in favour of Mr. O. V. S. BULLEID, Chief Mechanical Engineer of this Administration and former member of the Permanent Commission, was also approved subject to the reservation that the alteration of the Rules and Regulations concerning the nomination of Members of Honour, will be ratified by the London Congress.

* * *

According to Art. 6 of the Rules and Regulations of the Association, one third of the members of the Permanent Commission shall retire at each Congress and shall be eligible for re-election.

This stipulation is applicable to twenty members, and according to the precedents, it was decided to propose the renewal of their mandates expiring at the 16th Session. The re-election will be made at the first meeting of the Permanent Commission, which will be held in London. *(See List in Appendix.)*

Then, the GENERAL SECRETARY informed the Meeting of the various arrangements made for the organisation of the London Congress to be held at « Church

House » from the *19th to the 26th May 1954.*

These arrangements refer to the *travelling facilities* for the delegates and the accompanying ladies;

These arrangements refer to : the *tra*-Rules and Regulations of the Association, the list of questions, the programme of the Session, etc.;

— the *questionnaire* giving all the information relating to the sojourn of the delegates in London and which is to be sent out by the British Local Organizing Commission.

The Assembly was also informed of the progress achieved in respect of the preparatory works for the London Congress. Most of the reports to be published for discussion in sections have been received by the Secretariat, and their publication in the *Bulletin* has started in September 1953. All necessary measures have been taken to arrange for the reports to be, in ample time, in the hands of the delegates, before their departure for London.

Mr. HARRINGTON, *Chief Officer, British Railways, and President of the Local Organizing Commission of the London Congress,* reported on the steps taken for the constitution of the Honorary Committee and the Executive Committee of the Session. The Honorary Presidency will be assumed by a Member of the Royal Family, the Honorary Vice-Presidency being reserved to the Minister of Transport of Great Britain. The effective President of the Session will be the President of the British Transport Commission.

Mr. HARRINGTON gave also some information about the organisation of the Congress and the functioning of the various services.

* * *

The GENERAL SECRETARY then gave the names of the personalities chosen to assume the functions of Presidents of the five Sections as well as the names of the Principal Secretaries of Section. (*Approved.*)

Finally, the appointment of the Special Reporters, who will be called upon to prepare summarized reports on the various questions for the discussions at the London Congress, were confirmed.

Mr. GHILAIN recalled on this occasion that the Summaries formulated by the Special Reporter are the subject of a discussion and restated during meetings, gathering for each question, the reporters, the special reporter, the President of the Section, the Principal Secretary and the General Secretary.

* * *

The provisional statement of receipts and expenditure for the year 1953 and the provisional budget for the financial year 1954 were submitted to the Meeting and duly approved.

After consideration of the present financial position, the Assembly decided to apply as amount of the variable subscription for 1954 : 0.28 Gold franc per kilometre, agreed to by the Permanent Commission at the London Meeting of the 5th March 1951.

* * *

Information was also given about the changes which occurred in the membership since the meeting of the 17th January 1953.

As new membership, it must be mentioned :

the Tasmanian Government Railways : 988 km (612 miles) and the Deutsche Schlafwagen Gesellschaft, the latter as affiliated Organisation.

The International Railway Congress Association at present includes 34 Governments, 9 Organisations and 102 Railway Administrations with a total mileage of 451 000 km (280 000 miles).

* * *

The Meeting ended after the examination of various points concerning the activities of the Association since the last session of the Permanent Commission.

The General Secretary, (s.) P. GHILAIN. *The President,* (s.) M. DE VOS.

List of Members of the Permanent Commission

OF THE

INTERNATIONAL RAILWAY CONGRESS ASSOCIATION

(21st NOVEMBER 1953)

President :

M. **De Vos** (3), directeur général de la Société Nationale des Chemins de fer belges; 19, rue du Beau-Site, Bruxelles.

Vice-presidents :

Goursat (1), directeur de la Région du Nord de la Société Nationale des Chemins de fer français; 18, rue de Dunkerque, Paris (X[e]);

P. Ghilain (2), directeur honoraire du Service du Matériel et des Achats de la Société Nationale des Chemins de fer belges; 19, rue du Beau-Site, Bruxelles.

Members of the Executive Committee :

Dorges (3), inspecteur général des Ponts et Chaussées, secrétaire général aux Travaux publics, directeur général des Chemins de fer et des Transports au Ministère des Travaux publics et des Transports; 244, boulevard Saint-Germain, Paris;

The Rt. Hon. Lord **Hurcomb** (1), G.C.B., K.B.E., Chairman, British Transport Commission, 1947-53; 47, Campden Hill Court, Campden Hill Road, Kensington, London, W. 8;

Sir Gilmour **Jenkins** (2), Permanent Secretary, Ministry of Transport and Civil Aviation (Great Britain); Berkeley Square House, Berkeley Square, London, W. 1.

Ex-presidents of session, members ex-officio :

Ing. G. **di Raimondo,** directeur général des Chemins de fer de l'Etat italien; Rome;

Ibrahim Fahmy **Kerim**; Le Caire;

D[r] W. **Meile,** ancien président de la Direction générale des Chemins de fer fédéraux suisses; Brügglerweg, 11, Berne.

Members :

Mohamed Aref **Aboul Ata** (3), sous-secrétaire d'Etat au Ministère des Communications d'Egypte; Le Caire;

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(1) Retires at the 16th session.
(2) Retires at the 17th session.
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(1) Retires at the 16th session.
(2) Retires at the 17th session.
(3) Retires at the 18th session.

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N... (3) Argentine.
N... (2) China.
N... (2) Great Britain.
N... (3) Great Britain.
N... (3) New-Zealand.
N... (2) Rumania.
N... (2) Switzerland.

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(1) Retires at the 16th session.
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SECRETARY'S OFFICE : 19, rue du Beau Site, Brussels.

General Secretary : **P. Ghilain.**

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Note issued by the Central Office of International Railway Transport, Berne.

APPENDIX I TO CIM.

The « Prescriptions relating to materials and objects which can be transported under certain conditions »,

which form Appendix I of the International Agreement concerning the transport of goods by rail (CIM) have been brought up to date by a Committee of experts ad hoc during 1951 and 1952.

The text they agreed upon was submitted for approval to the member States according to the procedure laid down in article 60, paragraph 3 of CIM. As no objections were raised, the decisions of the Committee are taken as approved and the new prescriptions came into force on the 1st September 1953.

Amongst the innovations these include, mention must be made in particular of the creation of three new classes, namely for combustible materials, (III*c*) for radioactive materials (IV*b*) and for various materials (VII), new appendices concerning the regulations about receptacles in aluminium alloy (Appendix II), tests in conjunction with inflammable liquids in class III*a* (Appendix III) and the regulations concerning containers (Appendix VI) for transporting materials listed in Appendix I. In addition, in order to conform with the procedure laid down in other fields for marking the dangerous nature of the materials in question, the labels prescribed in Appendix I, reduced to 9 types instead of the previous 14, have been reexamined and with the modification of certain symbols will in future, to show they are actually danger labels, be orange in colour.

The new prescriptions can be obtained from the Central Office of International Railway Transport, 36, rue Monbijou, Berne, as follows :

French and German texts on facing pages.	4,— Swiss francs
French or German text alone	2.50 Swiss francs

An italian text will be issued later.

For the new text of Appendix I to CIM, the Central Office has also prepared an « *Alphabetical Table of the materials and objects covered by Appendix I to CIM, with marginal notes showing the relative regulations* ».

This alphabetical table will greatly facilitate reference to Appendix I for industrial and business firms. It is published separately in French, German and Italian, and costs 2 Swiss francs in each case. The Italian text will be published shortly.

Orders can be sent to the Central Office.

* * *

List of additional delivery times in the case of international goods traffic.

The *Central Office of International Railway Transport* has revised the « *List of additional delivery times* » applicable in international goods traffic according to article 11, paragraph 3, of the International Agreement concerning the transport of goods by rail (CIM), the last issue of which dated the 1st March 1947 has since undergone several modifications.

The new list, which gives the additional times as at the 1st June 1953, for all the States belonging to CIM, will be kept up to date by supplements. It can be obtained from the Central Office, 36, rue Monbijou, Berne; price : 50 Swiss centimes.

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